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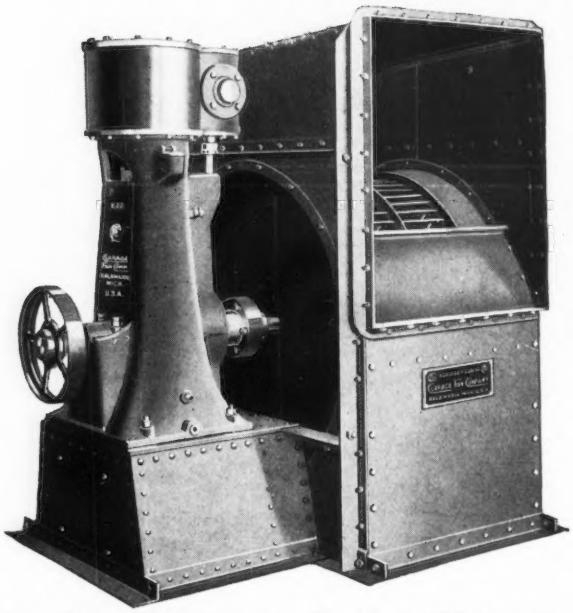

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THE HEATING AND VENTILATING MAGAZINE

FEBRUARY, 1919

ENGINEERING ECONOMICS OF HEATING

With a Method of Predetermining Coal Requirements for Steam and Hot Water Heating Systems.

BY M. WILLIAM EHRLICH

(Abstract of Paper Presented at the Annual Meeting of The American Society of Heating and Ventilating Engineers in New York, January 28-30, 1919.)

Considering coal required for heating purposes only, this paper gives an outline of the theory of weather control over heating. The missing factor that has been overlooked or neglected in contemporary investigations, is embodied in a simple new law that gives results that may be checked in practice. In the main, actual operating plants for which corresponding operating data were available, form the basis of the study and the conclusions derived. Office buildings, manufacturing plants, department stores, apartment houses and residences located in different sections of the country furnished the information. Invariably the installation of a system of records in plants not so provided meant a reduction in the coal consumed, only after several months use.

This work proved that it is not fair to relate coal consumption to cubic contents of the building heated. Nor does a relation of coal consumption to installed heating surface, give conclusive results. If one class of building were considered, all operating under similar conditions, a straight line relation might be established by either method, but the results would not apply to different conditions. Still, as heating is a known process that follows the same law in all instances, so there must be a fundamental relation that exists under all conditions.

Following this thought, the fundamental feature was uncovered in the course of time. It shows that the economics of heating, like any other phase of economics, follows a natural law. The human element modifies this somewhat, but the weather control over heating is the most important factor, as will be shown. Combining the two, all figures are at once placed on an empirical basis and the coal consumption is determined by this new condition. Formulating this theory of weather control over heating gives a method for predetermining the coal requirements which in turn becomes a standard for measuring the relative fuel economy of any heating plant having a steam or hot water installation.

DEVELOPMENT OF THE THEORY.

In dealing with owners and managers of heating plants, it becomes immediately clear that their main concern is with the coal bill. Is the coal bill really

high? This question can be answered for every particular condition. The probable coal requirements for the service, however, must first be known in order to establish a relation. The advantage of predetermining the coal consumption is, therefore, obvious. And here is where the weather control has its sway.

TABLE 1. MONTHLY DIVISION OF HEATING SEASON IN SOME STATES.

Note.—Figures are percentages of the total for the season which is 100%.

Month	New York	Michigan	Penn.	Ohio	Missouri
October	3%	5%	8%	3%	3%
November	7	12	12	12	11
December	15	15	13	18	18
January	25	18	15	21	22
February	22	21	16	19	20
March	20	17	19	14	13
April	5	8	12	11	10
May	3	4	5	2	3

TABLE 2. AVERAGE HEATING REQUIREMENTS IN VARIOUS CITIES.

Note.—Figures given are percentages of maximum conditions.

Boston	47%
Columbus	47
Detroit	50
New York	42
Philadelphia	41
St. Louis	36

The first definite result of this study that materialized, is shown in Tables 1 and 2. The figures given are based on a few actual instances in cities of the various States named. They may be used in determining the steam requirements. Thus in New York 7% of the total steam or coal consumption takes place in November, while January represents 25% of the total.

In Table 2 are given figures for the corresponding plants that show what percentages of the maximum conditions the entire season represents. Say that the maximum condition requires 0.3 lbs. of steam per hour per square foot of radiation; now, in a plant operating 4000 hours during the heating season, this would mean a maximum possible requirement of 1200 lbs. of steam. But according to the tabulation only 42% of this would be used under New York weather conditions. Therefore, 1 sq. ft. of direct steam radiation would consume only 504 lbs. of steam during the heating season. The same reasoning applies to coal consumption.

This formula with its factors was the first step in recognizing development which proved that the weather is the control over heating requirements. Combining this with more and later information, resulted in the formula and figures given in Table 3 which appeared in the March 5, 1918, issue of *Power*. According to these, 100 sq. ft. of direct steam radiation used in New York City for a season of 4000 hours, would consume 3.12 tons of hard coal. By the same method it is found that a heating system in Boston operating say 3,000 hours during the season would consume only 2.55 tons anthracite coal per 100 sq. ft. direct steam radiation.

TABLE 3. FIRST FORMULA FOR COAL REQUIREMENTS.

Tons coal required for heating season $= \frac{\text{Sq. ft. Radiation} \times \text{Hours} \times f}{10{,}000{,}000}$

VALUE OF FACTOR "f"

	Hard Coal	Soft Coal
Boston, Mass.	85	80
Columbus, Ohio	84	78
Detroit, Mich.	89	83
New York, N. Y.	78	73
Philadelphia, Pa.	75	70
St. Louis, Mo.	64	60

However, this form of computation with its involved factors, is not for the

use of the laymen, so, when recent conditions warranted it, the chart shown in Fig. 1 was prepared for the use of the mechanics and tradesmen in the heating field. This chart was intended as a guide to show the probable coal requirements of different classes of residences, and gives only a very general apportionment of coal on the basis of the number of rooms in the house. Class 1 represents the ordinary suburban or so-called country style detached house. Houses built in blocks or of the semi-detached type are placed in Class 2. No house, as a whole, is placed in Class 3 except in special cases, the classes referring to the curves of Fig. 1. A house having a large glass surface, or one that is very much exposed to the weather, may have one or two of its coldest rooms placed in Class 3, but the rest of the house remains in Class 1 or 2 as the case may require. A typical ten room house that has three really cold rooms and seven average rooms would be given 12¾ tons according to the diagram. But a ten room house in a block well built-in, would be allowed only 8 tons of coal. Judgment and experience is, of course, required in the use of these figures.

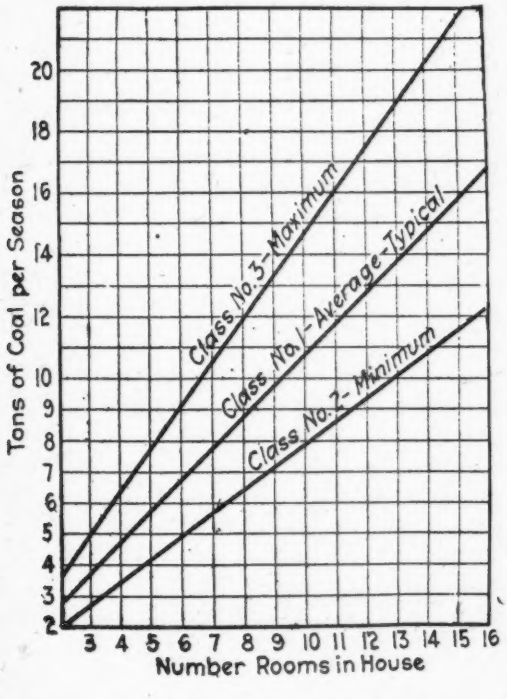

FIG. 1.—GENERAL APPORTIONMENT OF COAL FOR HOUSE-HEATING SYSTEMS.

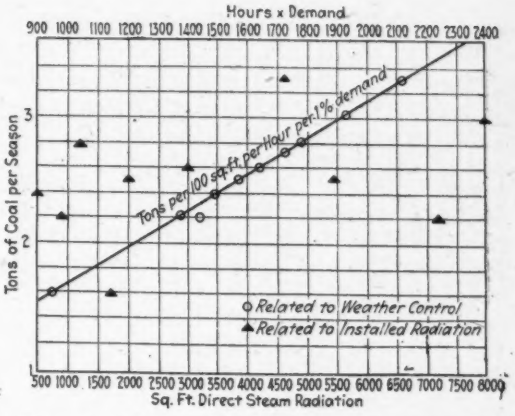
Hours x Demand
Tons of Coal per Season
Tons per 100 sq. ft. per Hour per 1% demand
Related to Weather Control
Related to Installed Radiation
Sq. Ft. Direct Steam Radiation

FIG. 2.—COAL REQUIRED FOR HEATING NEW YORK APARTMENT HOUSES.

At that time, too much publicity could not be given to the economics of the coal question. So for the apartment house manager, a closer set of figures was developed along the basis of weather conditions and an average number of hours operation. From these figures the diagram Fig. 2 was plotted for New York apartment houses. This shows, for example, that an installation of 3000 sq. ft. direct steam radiation would require 69 tons of coal which is 3.3 tons per 100 sq. ft. for the heating season.

These developments in combination with more figures of actual coal consumption showed that a definite relation must exist between them and the weather variations of the locality. Further concentrated study and deeper analysis of all the factors that enter into the problem proved this contention well founded.

(The author here presented charts and tables showing the comparative coal consumptions under various conditions in steam heated buildings. The wide variation in the items indicated the futility of comparing figures on coal consumption when the hours of operation and outside weather conditions are not known.)

The figures presented, however, point out that the true relation, as shown by weather control, is the *coal required for 1 sq. ft. radiation operating for 1 hr. at 1 per cent demand.*

To emphasize the importance of this simple new law, the diagram Fig. 3 has been constructed from the figures referred to. The records shown by solid black triangles suggest that there is a wide divergence in the use of coal by heating systems,—only because the radiation alone is considered. And combined with the top scale of this diagram points out that when the real factors of operation and demand on the system are used with relation to the coal consumption, then there is a visible reason for one building requiring a greater coal tonnage to give adequate heating service than another building of similar characteristics.

These features are in part an explanation of the basis used in formulating the master chart shown as Fig. 4. The remaining portion is made up of the personal factor as found in numerous actual plants that are considered to be operated with a commercially satisfactory degree of economy, as found by comparing theoretical requirements with actual usage, when related to the weather control over heating.

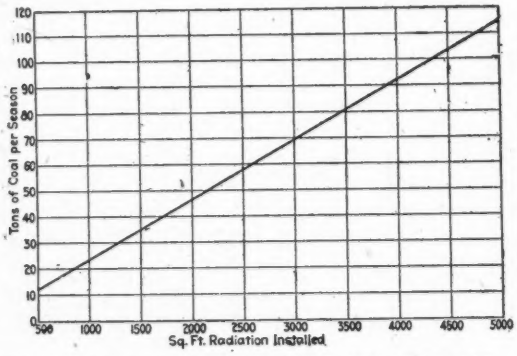

FIG. 3.—COAL REQUIREMENTS IN AVERAGE PLANTS.

AVERAGE WEATHER CONDITIONS.

A tabulation of the average monthly outdoor temperatures will serve as a basis for determining the relative requirements and tax on the heating system in different cities, with the aid of the formula herewith.

$$\frac{I_t - O_t}{M_t} = \text{Percent demand.}$$

where I_t = inside room temperature.

O_t = prevailing outdoor temperature.

M_d = maxium temperature difference used in design.

TABLE 4.—AVERAGE MONTHLY OUTDOOR TEMPERATURES FOR 33-YEAR PERIOD.

(Does not include cold snap of 1917-18 season)

Locality	Lowest observed temp.	Month and Average Temperatures Oct.	Nov	Dec.	Jan.	Feb.	Mar.	Apr.	Aver. of season
Albany, N. Y.	-24	50	38	28	22	24	32	46	34.3
Amarillo, Texas	-16	56	44	36	34	37	45	55	43.9
Atlanta, Ga.	-8	62	52	45	42	45	52	61	51.3
Bismarck, N D.	-44	44	26	15	7	8	22	43	23.6
Boise, Idaho	-28	50	40	32	29	34	42	50	39.6
Boston, Mass.	-13	52	41	32	27	28	35	45	37.1
Chicago, Ill.	-23	53	39	29	24	25	34	46	35.7
Cleveland, Ohio	-17	53	40	31	26	27	34	46	36.7
Des Moines, Iowa	-30	52	37	26	20	24	36	51	35.1
Green Bay, Wis.	-36	47	32	21	15	17	22	41	28.6
Harrisburg, Pa.	-14	54	42	33	29	30	38	51	39.6
Indianapolis, Ind.	-25	55	42	33	28	31	40	52	40.1
Kansas City, Mo	-22	56	42	32	26	30	41	54	40.1
Knoxville, Tenn.	-16	58	47	40	38	41	48	57	47.0
Little Rock, Ark.	-12	63	52	44	41	44	53	63	51.4
Louisville, Ky	-20	58	46	38	34	37	45	56	44.8
New Orleans, La.	7	70	61	54	53	56	62	68	60.5
New York, N Y	-6	56	44	34	30	31	38	48	40.1
Oswego, N Y.	-23	51	39	29	24	24	31	43	34.4
Port Huron, Mich	-25	50	37	27	22	22	30	42	32.9
Portland, Ore.	-2	53	46	41	39	41	46	51	45.3
St. Paul, Minn	-41	48	31	19	12	15	28	46	28.4
Salt Lake City Utah	-20	52	40	32	29	33	41	50	39.6
Washington, D C	-15	57	45	36	33	34	42	53	42.9

In computing the per cent demand in this manner, it is important that the temperatures considered correspond to the conditions in that period of operation or else misleading results will be obtained. This means that the per cent demand may be for a day, a week, a month, or the entire season, so care must be exercised in values for the letters in the formula.

Another step in which the tabulation of outdoor temperature will be found useful, is in the determination of the division of the heating season. The formula in Table 5 must be used in this connection. As shown in the example, it can be easily determined what part of the total steam and coal requirements is represented by each month of the season.

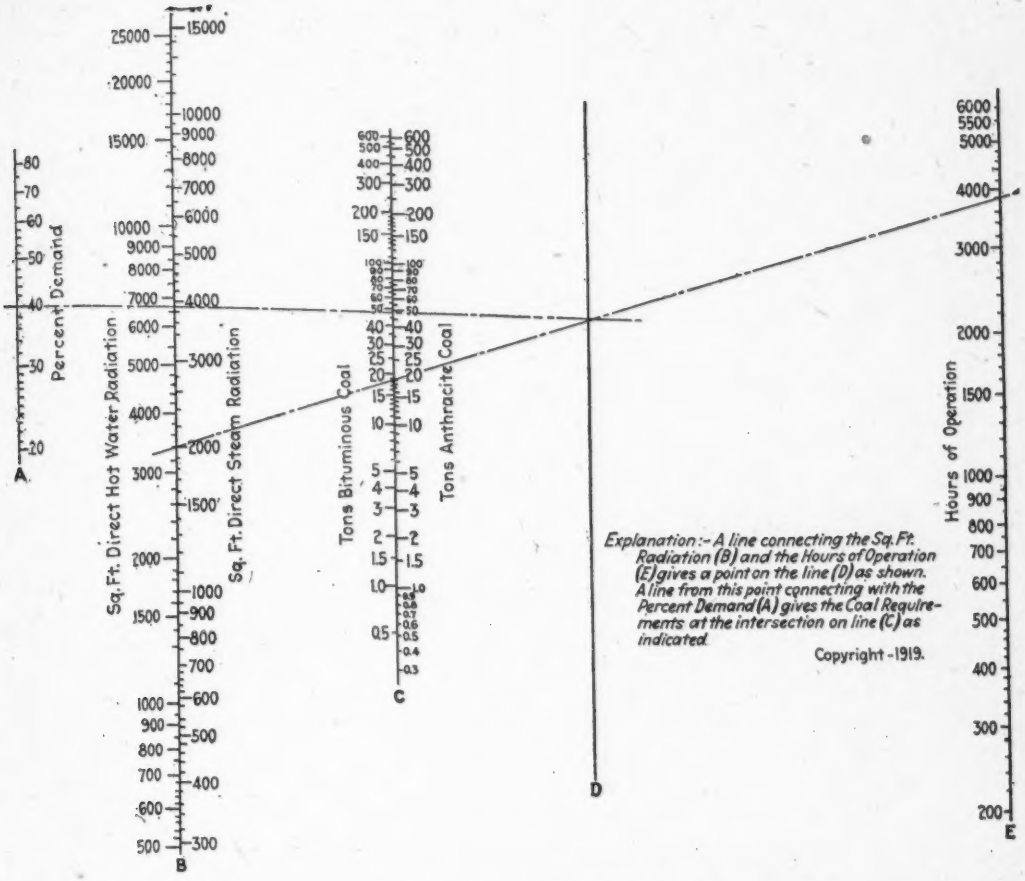
Percent Demand
A
Sq. Ft. Direct Hot Water Radiation
Sq. Ft. Direct Steam Radiation
B
Tons Bituminous Coal
Tons Anthracite Coal
C
D
Hours of Operation
E
Explanation:- A line connecting the Sq. Ft. Radiation (B) and the Hours of Operation (E) gives a point on the line (D) as shown. A line from this point connecting with the Percent Demand (A) gives the Coal Requirements at the intersection on line (C) as indicated.
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FIG. 4.—STANDARD METHOD OF DETERMINING COAL REQUIREMENTS.

For all classes of buildings with steam and hot water heating systems under any condition of weather and operation.

PREDETERMINING COAL REQUIREMENTS.

With this relation of weather to demand and coal consumption established, the figures have been assimilated with records of actual operation. The result is the chart in Fig. 4. With its aid coal requirements for steam and hot water heating systems for any weather conditions in any locality for any number of hours operation, may be determined graphically. No figuring is required and nothing remains to be assumed. The results it gives closely approximate actual conditions of fair operation because the human factor and other variables have been taken into account. A fair quality or grade of coal commercially clean is considered. The aim has been for a fair average value that represents a minimum of waste in the use of fuel for heating purposes. Therefore, a building using more coal than shown by the chart for that condition is assumed to be wasting good fuel unnecessarily.

The chart is primarily based on steam heating. Hot water systems have been added on the basis that 1.6 sq. ft. hot water radiation is required to give the same results as 1 sq. ft. steam surface. But hot water installations are more easily controlled, giving better coal economy, so this factor has been included.

The chart also shows that there may be a slight gain in economy by the

TABLE 5—DIVISION OF HEATING SEASON.

Steam and coal requirements for different months of the season, given as a percent of the total.

$$\frac{I_t - O_t}{N} = \text{Percent required.}$$

where I_t = inside room temperature.
O_t = prevailing outdoor temperature.
N = sum of $I_t - O_t$ for the different months considered.

Example:	Oct.	Nov.	Dec.	Jan.
I_t	70	70	70	70
O_t	44	26	15	7
$I_t - O_t$	26	44	55	63
$\frac{I_t - O_t}{N} = \%$	8	13.5	16.9	19.4

Feb.	Mar.	Apr.	
70	70	70	
8	22	43	
62	48	27	
			N = 325
19.1	14.8	8.3	100%

use of bituminous coal as against anthracite. However, the practical saving is not so great as relative heating values of the coals would indicate. This is due to the nature of soft coal and the way it is usually cared for on the grates under the boilers. There is some advantage to be gained though in having boilers suitable for either fuel. Then the coal market will show whether to favor one grade or the other. Whichever is the lower priced, that is the coal to use,—if it is obtainable.

STANDARDS FOR RADIATION

The question may be raised as to what is meant by a square foot of direct radiation, as this factor is included in the solution of the coal problem by weather control. In such cases where the data would not line up, then the radiation was reduced to an equivalent heating surface. (The author here included a chart showing how he obtained this equivalent. All installations were checked against these values so that a square foot of radiation would mean the same in every case.)

PRACTICAL APPLICATION OF THE METHOD.

Now that the various points involved have been touched on, it is well to understand how these items are interwoven in obtaining practical results on the basis of weather control over heating. An example should serve the purpose.

Take a system having 2000 sq. ft. direct steam radiation located in weather conditions giving a demand of 40 per cent. The hours of operation or the period during which steam is turned on during the season is 3800 hours in this plant. The problem is to find how much coal such heating plant would require to meet the given operating conditions. This is simply solved by connecting the known values with straight lines, as shown in Fig. 4. The answer found is 50 tons of anthracite or 48 tons bituminous coal. This means that the particular plant considered should use not more than 2.5 tons of hard coal nor more than 2.4 tons of soft coal per 100 sq. ft. radiation during the season. The same total results would be obtained for a hot water system of about 3400 sq. ft. radiation operating under the same conditions. The rate per 100 sq. ft. hot water radiation for the season would then be 1.41 tons soft coal and 1.47 tons anthracite.

The considerations named apply even in the case of a combined heating and steam power plant. The amount of coal remains as given for the heating service. This subtracted from the total coal consumption of the plant and its equivalent gives a remaining quantity that shows the other useful service the coal has performed. If this figure is too high for the power load carried, some preventable loss probably exists and some action should follow to restore economy.

For a monthly check in operating conditions to keep the coal bills at an equitable level, it is well to plot a load curve for that particular plant. The predetermined figures it gives serve as a check against waste and at the same time show the future requirements. Such curve may be easily constructed with the aid of the information presented. The average weather conditions are taken from the tabulation, the indoor temperature is that maintained in the building while the division of the season and the percent demand are obtained by the formulas. These figures will all be a percent of the total, and that total is in turn determined by the use of the master chart. To illustrate this, Fig. 5 has been prepared for Chicago conditions. To emphasize the fact that the heating system is not taxed to full capacity, the percent demand has been replotted in Fig. 6, showing more clearly that only a part of the maximum is utilized under the averages that prevail during the heating season.

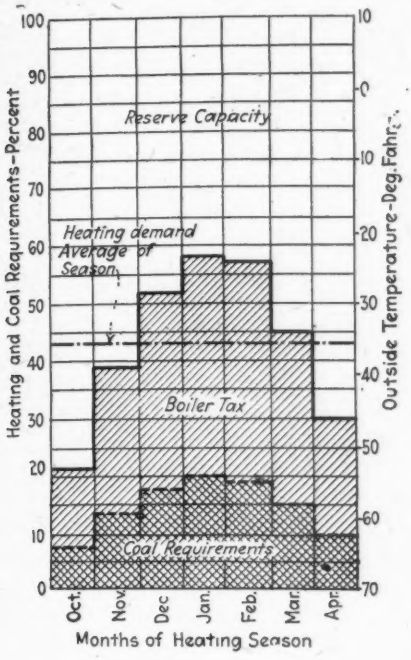


FIG. 5.—MONTHLY COAL REQUIREMENTS AND TAX ON BOILER CAPACITY TO MEET CHICAGO WEATHER CONDITIONS.

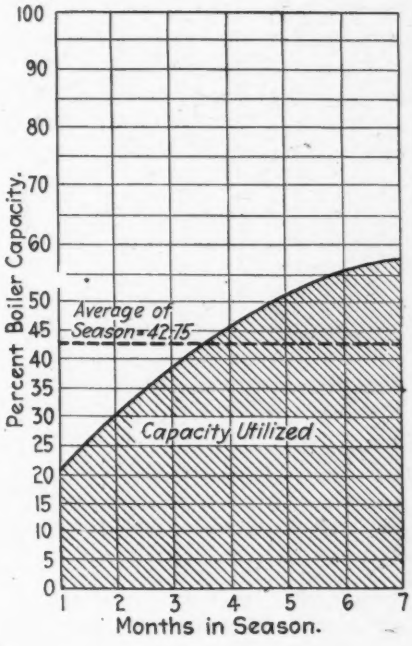


FIG. 6.—BOILER CAPACITY UTILIZED OR TAX ON HEATING SYSTEM DURING THE SEASON—CHICAGO CONDITIONS.

This, then, is the story of weather control over heating operations. It is an attempt to formulate standards that are needed by the heating engineer. Of course wider experience with many more building conditions will help to check or modify the factors included. However, the main thought or idea here expressed, may prove novel in bringing out a definite relation between outside temperature fluctuations and the work of a heating system. A desire for more accurately and more rapidly solving everyday problems of plant economy, combined with a leaning toward analysis, has resulted in this work. And,—it checks with practice to a close degree.

CHICAGO COMMISSION ON VENTILATION

CONSTRUCTION AND EQUIPMENT OF PORTABLE SCHOOL BUILDINGS

Experiences in the Use of this Type of Building, with Suggestions for Its Heating and Ventilation.

By JOHN HOWATT AND SAMUEL R. LEWIS.
Committee on Portable School Buildings.

Introduction

There is a constant, normal use, especially in large cities, of portable school buildings, as a makeshift pending the construction of permanent buildings, or during the period between the overflowing of an existing building and the construction of a permanent addition. The portable school building is the common expedient by which Boards of Education keep up with shifting populations. Large cities are usually several years behind the demand for permanent school buildings. As an illustration, there are over 300 portables, each seating 48 pupils, in Chicago, so it can readily be seen that the problem is one warranting study and investigation. Portable school buildings are, in many of their characteristics, very similar to some of the permanent school buildings erected in rural districts. During the past two years there has been an abnormal increase in the number of these portable or temporary buildings on account of the high cost and scarcity of building materials, and because of government restrictions on permanent construction.

The portable schools are built in one and two-room sizes. The two-room type usually is constructed of two single-room units placed end to end, with a hall extending across the entire building, connecting them. It is therefore unnecessary to discuss more than the single-room type. As these buildings may have to be moved to other sites, it is necessary that they be of construction that renders them easily portable. This means that the walls cannot be plastered, and further means that walls, floor and roof must be so framed that they can be separated in sections and loaded on wagons.

It is the common experience that communities do not take kindly to the portable school. Objection is made to the "shanties," and demands are made for permanent buildings oftentimes before the needs will warrant the investment, although the portable school can really be made into an excellent class room. It would appear the part of economy, therefore, to make the portable attractive in appearance, and comfortable. Keeping the buildings neatly painted outside, with well-kept walks and grounds around them, and well-cleaned and decorated inside, tends to alleviate dissatisfaction.

Inquiries were made to determine the experience with portable school buildings, of various States and cities. The following notes cover the salient points in the replies to these letters of inquiry, and are submitted, together with illustrations of some of the more interesting details. The committee met with most courteous and satisfactory

treatment, having received plans and other data from nearly every authority consulted.

SYNOPSIS OF REPLIES

1. State of Illinois.
F. G. Blair, Superintendent of Public Instruction.

It is recommended that portable schools be not over 24 ft. wide, with the light from the left side only, although high and shaded windows on the right side are highly desirable as they permit cross ventilation. There should be a vestibule and wardrobes, and the wardrobes should be so designed that a free circulation of air from the room may pass through, thus insuring that they shall be heated. Prof. Blair emphasizes the need for artificial humidification.

2. State of Wisconsin.
The superintendent's office does not have jurisdiction over such matters. They are a function of each city superintendent.

3. State of Minnesota.
Requires one side light on the left with windows for ventilation on the right permitted. Fresh air, properly heated, must be provided, and the minimum sizes of ducts, heaters, etc., are specified.

4. State of Massachusetts.
The requirements in general are the same as for Minnesota, with the addition that the placing of the heater in a separate room is particularly recommended.

5. State of New York.
Frank H. Wood, Chief of School Buildings and Grounds Division.

Exercises supervision over schools of villages and cities of the third class only, and these do not use portable buildings very extensively. Artificial ventilation, however, is compulsory, and all buildings are visited by a State inspector to insure compliance.

6. State of Pennsylvania.
Herbert C. Eicher, Assistant Secretary, State Board of Education.

Ventilation of portable buildings is required, and plans must be approved. The department will furnish suggested plans where requested.

7. State of Michigan.
J. M. Munson, Deputy Superintendent of Public Instruction.
No special plans are furnished. Ventilation, however, is required but no special recommendations are made.

8. Winnipeg, Manitoba, Canada.
J. B. Mitchell, Architect and Commissioner of School Buildings.

The custom is to build temporary buildings one-story high, but they are not of the portable type and usually comprise eight to twelve class-rooms. They have brick outside and corridor walls, plastered interior, direct steam heating, and in general cannot be said to come under the head of portable schools.

9. City of Boston, Mass.
Herbert L. Patterson, Civil Engineer.
(Illustrations—plan (No. 1), and section through heater (No. 2).

The walls are of 4-in. studs with building paper and drop siding outside, and building paper and sheathing inside. The floors are double, with paper between the two layers.

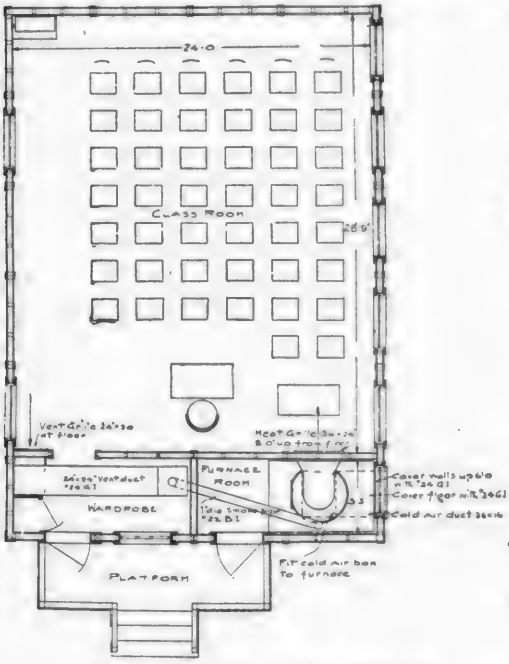


FIG 1.—FLOOR PLAN—BOSTON.

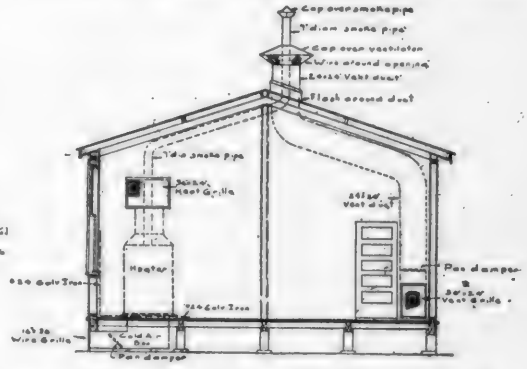


FIG. 2.—SECTION SHOWING BOSTON HEATER.

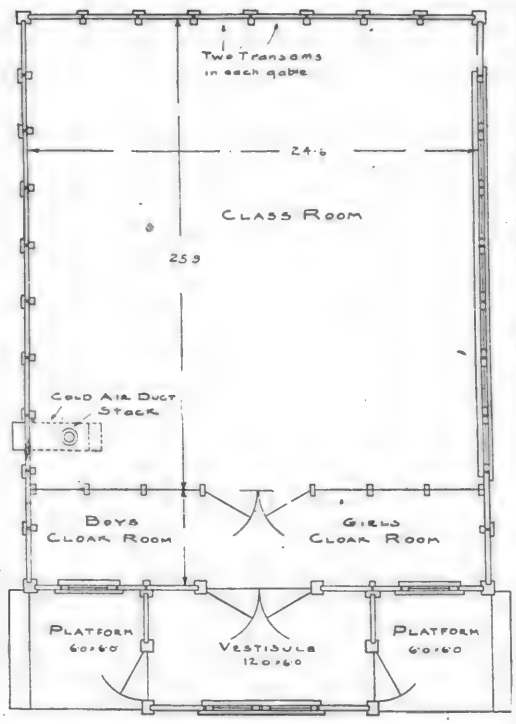


FIG 3.—FLOOR PLAN—TOLEDO.

In addition, the under side of the floor joists is covered with insulating paper to form dead air spaces. No ceiling is used, the roof being ⅞-in. spruce covered with composition roofing.

It will be noted particularly that the heater is in a separate room giving the advantage of cleanliness and non-interruption of work by the janitor. Unusual liberality for ventilation is shown in the design since the heater has a 25-in. grate, and the vent duct is 24-in. x 24-in.

10. City of Columbus, Ohio.

The standard, interchangeable type of portable school house, manufactured by one of the large companies engaged in such business, is used. The walls are solid, comprised of two ⅞-in. thicknesses with paper between. The floors are double with paper between. The roof is single, with composition above. The heater is placed in the room, the vent flue being heated by the smoke pipe.

11. City of Toledo, Ohio.

Edwin M. Gee, Architect and Director of Schools.

(Illustrations—plan (No. 3) layout of portables No. 4 A and section through heater (No. 4).

The same type of building is used as in Columbus. It has been found particularly desirable to use this fabricated interchangeable type because of its flexibility, and many have been erected and taken down several times. In Toledo, in some cases, it has been necessary to use portables entirely for a new district. The arrangement where eight are placed on a lot in a hollow square, two on each side, having the windows all on the outside, has been found very attractive and we are able to show a sketch layout of the scheme as used for the Ketcham school. The central playground is about 100 feet square. The interchangeable features of the fabricated houses, which permits the doors and windows to be placed on either end or side, is particularly desirable. Ninety-eight of these portables are in use in Toledo.

12. City of Chicago, Illinois.

John Howatt, Chief Engineer, Board of Education.

(Illustrations-plan (No. 5), and section through heater (No. 6).

The walls are built with 4-in studs, with paper and sheathing outside, and wall board inside. The floor is double, with paper between layers. The roof is sheathed with paper and wood. The entire outside, including the roof is covered with galvanized iron, as required for fire protection by city ordinance. An air circulation between the studs from the space under the floor to the attic is particularly arranged for in the design. The complaint is made of cold floors in the winter, and of unduly high

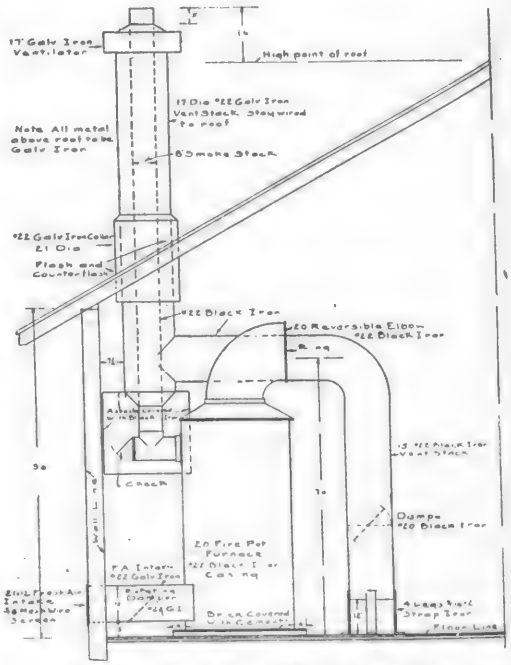


FIG. 4.—SECTION THROUGH TOLEDO HEATER.

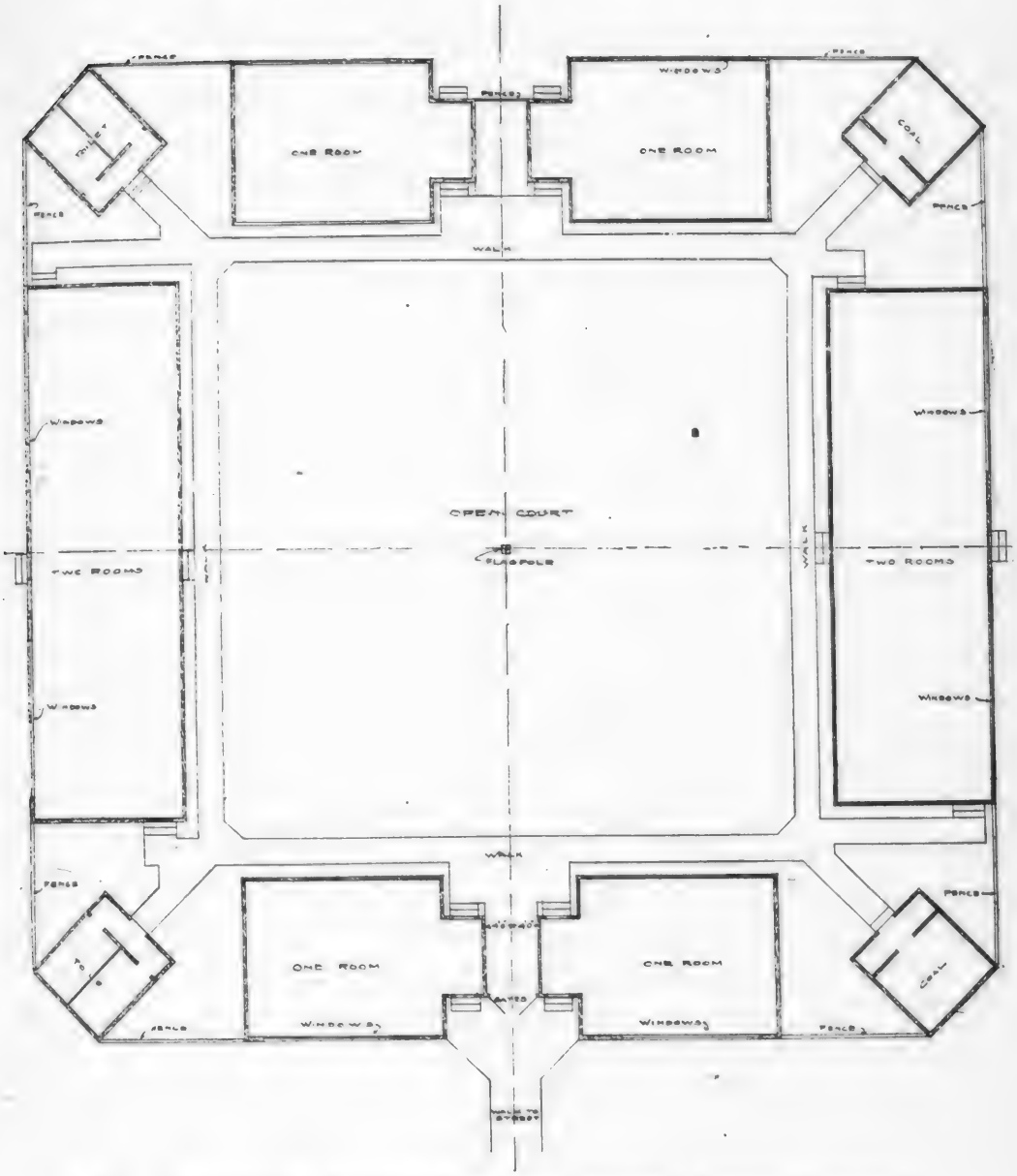


FIG. 4A.—LAYOUT OF PORTABLES FOR KETCHAM SCHOOL, TOLEDO.

temperature in warm weather, even though cross ventilation is provided for. There are various types of portable schools used in Chicago, but experience in general is that the saving by using the knock-down type is more than offset by the heavy damage done them each time they are moved and re-erected. The rules of the Bureau of Fire Prevention require that the heater be placed as far as possible from the exit door.

13. City of Milwaukee, Wisconsin.
Frank M. Harbach, Secy., Board of School Directors.

It has been stated that many of the Milwaukee schools with their portables which are designated "barracks," look like a hen with her chickens. The heaters are placed in the rooms using an outside air supply, and in addition, shields to facilitate window ventilation are provided. They have no particular difficulty with heating or ventilation, or with cold floors. The floors are double with deafening quilting between the layers.

14. City of Cleveland, Ohio.
Robert J. Mayer, Jr., Heating Engineer.

(Illustrations—detail sheet (No. 7).

In general, the portables are satisfactory. It was found necessary to increase the original free area allowed between heater and encasement. The heater is placed in the room, with vent flue arrangements similar to those used in Toledo. The ridge timber when erected as a continuous single piece, tends to warp, causing the greatest difficulty when re-erecting. Wall board is used for interior lining and is reported as satisfactory. A 16 in. space is provided under the floor, and this is sealed off tight from the outside air in cold weather. Four vents into this space from outside, which may be closed perfectly tight, are provided, and are kept open during the summer as insurance against dry rot. Between the double floors a 1-in. space is provided with paper between the space and each layer of the floor. The paper is run up to the top of the baseboard to insure an air-tight joint. 4-in. studs are used in the walls, but all circulation of air between them from subfloor to attic is prevented.

15. City of Rochester, New York.
Edwin S. Gordon, Architect.

A large number of portables are used. They are of the interchangeable type made at home. The sectional wall panels are built up of two thicknesses of ⅜-in. pine, with

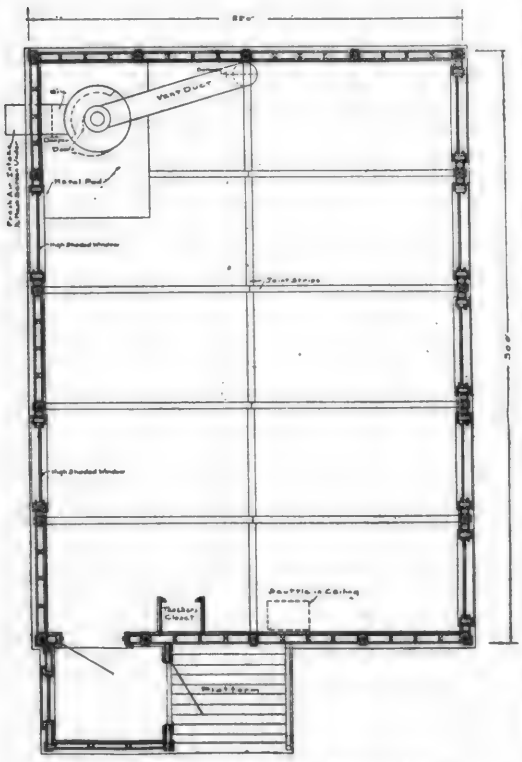


FIG. 5.—FLOOR PLAN—CHICAGO.

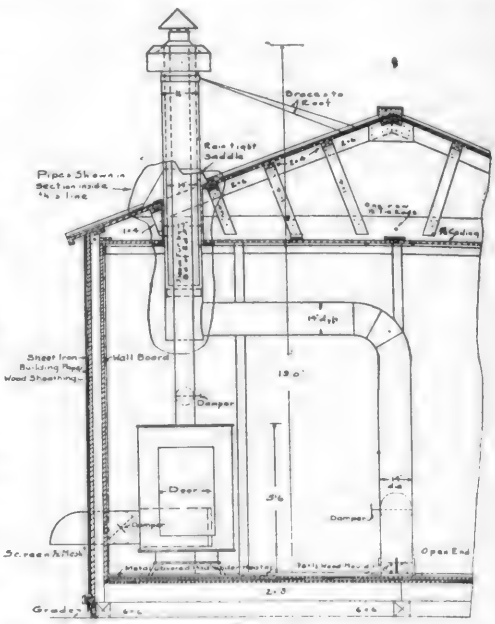


FIG. 6.—ELEVATION OF CHICAGO HEATER.

¼-in. laths spaced 15¾-in. on centers, and waterproof building paper between them. The floors are double and particular pains are taken to cut off circulation of cold air under them by means of a tight bulk-head of rubberoid paper extending some distance into the ground from the bottom of the sills.

16. Frank Irving Cooper, Architect, Boston—Chairman of Committee on Standardization of School House Building and Planning, National Education Association.

Mr. Cooper used a separate room for the heater, and has found it desirable to use a separate coal-fired heater of very small size to induce a draft in the vent flue; thus it is possible to insure a uniform intensity of draft through this flue regardless of fluctuations in the amount of heat which must be transmitted to the air. There will, therefore, be a tendency in such an arrangement for a continuous supply of fresh air regardless of its temperature, a result not attainable without a separate means of ventilation. Mr. Cooper's reply is the only one indicating any lack of satisfaction with composition board for interior lining.

17. City of Detroit, Michigan.
Delbert C. Smith, Chief Engineer.

The most satisfactory arrangement consists of two class rooms, with a space between about ten feet wide, enclosed, forming a separate furnace room, also cloak rooms and vestibule. Objection is made to the heat distribution, the rooms having very hot ceilings and cold floors. The fabricated

type of building is used, and the repairs are heavy, also when moved the breakage is excessive. Some portables are in operation with open-window ventilation, using stoves for heating. There are nine portables in use.

18. City of Seattle, Washington.
Reuben W. Jones, Secretary, Board of School Directors.

There are nearly one hundred portable school buildings used in Seattle, all heated with stoves having casings, and ventilated by the windows and doors. There are fresh air ducts from outside to the casing spaces, but apparently no vent flues are provided in connection with the chimneys. The climate is so mild that only where the site is unusually exposed do they install double floors or close off the sub-joist space. Seattle, in view of the present national condition affecting building materials, has built a number of six-room, temporary frame building of more substantial type, having plastered interiors, but these are heated by the same methods as those used for the portables. Mr. Jones suggests air circulation under the floor from the room, for warming the floor.

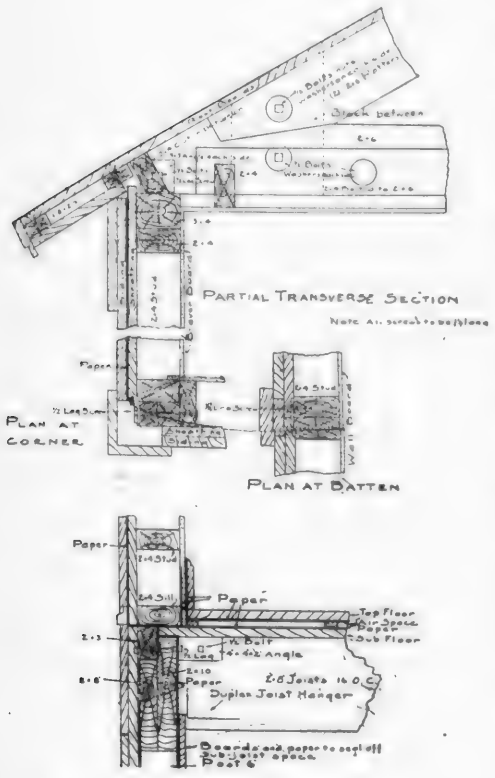


FIG. 7.—CONSTRUCTION DETAILS OF CLEVELAND PORTABLES.

19. City of Salt Lake City, Utah.
H. D. Bowman, Superintendent of Buildings.

Sixteen portables in use, fabricated type. Some are heated by stoves and some by direct radiation, and windows are used for ventilation. Cold floors and hot ceilings are found to be common. Very heavy depreciation is noted when buildings are to be re-erected. Mr. Bowman suggests the installation of a fan in connection with a furnace in a separate room, and air circulation from the room under the floor for warming the latter.

Discussion.

Based on the various plans studied, the foregoing replies, and our inspection of various buildings we submit the following suggestions:

The portable should be not over 24 ft. in width on account of the lighting provisions, and the class room should be about 30 ft. in length. Many authorities advise that east or west light is the best for class rooms and that all light should come on the pupils' desks from the left.

The entrance door should have a vestibule. Wardrobes are highly desirable and if made a part of the room will be heated sufficiently. Wardrobes can be made a part of the room by omitting any communicating doors, or by having large openings into the rooms at floor and ceiling. It is practicable even to arrange the exhaust openings so that the air from the room passes through the wardrobes on its way out.

The best fire prevention ordinances, as well as proper lighting requirements, dictate that the portable building shall have its main window side not closer to any other building than 30 ft. and its blind side not closer to any other building than 10 ft.

DRY WOOD REQUIRED IN CONSTRUCTION.

Comfort and economy will be conserved by particular care in workmanship as well as in selection of materials used in the construction. Dry wood is an excellent non-conductor of

heat and when combined properly with air spaces in which no circulation is permitted, makes a very warm building. These schools, however, are often built of wood which is far from dry, and their heating equipment is such as to encourage extreme dryness. Therefore, precautions in construction to prevent leakage of air, such as are taken in Cleveland, and illustrated, are excellent.

There must be no circulation from outside across the subjoist space in cold weather and no circulation between the studs at any time from this space to the attic. (This latter circulation, as well as the use of spaces between joists as air-ways, is usually condemned also in no uncertain tone by fire prevention authorities.) To counteract dry rot the sub-joist space may be arranged to be open to the outside air in summer, through the medium of several air-tight but removable shutters. Where the walls are not constructed with ordinary studs, but are built of two thicknesses of wood with paper between, the Rochester suggestion of ¼-in. air pockets with paper each side, seems worthy of some consideration.

The joints between floors and walls, and walls and roofs, as well as around window and door frames can easily be sealed air-tight with the paper diaphragm as suggested in the Cleveland drawing. The double floor with dead air spaces, above a sealed subjoist space, will go far toward solving the problem of cold floors. It is safe to say that no dependence should be placed under any circumstances, on any wooden material remaining even approximately air-tight. Composition board is much tighter than a ceiled wall or ceiling, but some makes are so thin and fragile as to be rather objectionable where re-erection is considered.

The Chicago preference is to build temporary rather than portable schools. The walls and roofs of the portables are covered with galvanized steel to prevent leakage, as well as for fire prevention. The Chicago floors have battleship linoleum as a top finish, this being an excellent non-conductor of heat, as well as being sanitary and noiseless.

HEATING OF PORTABLES.

The heating of portable school buildings is usually done by stoves or furnaces, although there are a few places where groups of portables are steam heated. Attempts have been made to heat them with gas radiators. Many portables are heated by the old cannon or railroad stove surrounded by a sheet-iron casing to protect the pupils near the stove. This is the cheapest heating arrangement and is the least efficient. Encased steam radiators having fans and motors mounted integrally with them, are on the market, and such outfits furnish a reasonable amount of ventilation for one room. These, however, require steam and electric current, and, therefore, can be used in special cases only.

The most practical method of heating portables is by jacketed school room heaters and a number of different makes of satisfactory design, are now on the market. These heaters are higher in first cost than the cannon stoves, but are far superior to them. In general, the portable school room heater comprises;

A coal-burning stove having some sort of a radiator above the firepot.

A casing surrounding the stove, arranged to take outside air or air from the room, at the bottom, and to discharge this air into the room at the top, through a horizontal screen or through an elbow.

A vent flue, leading from the floor to the outside, and combining with itself a smoke pipe so that the heat from the latter will induce a raising current of air in the vent flue.

The size of the heater required is, of course, dependent upon the size

of the room to be heated, and its location. It has been found that for a portable school room 22 ft. by 30 ft., a heater with a 24-in. diameter grate will be suffcient for zero weather, and will warm the fresh air. Placing the heater in a separate room, as shown on the Boston drawing, reduces the dirt, and prevents distraction of the pupils due to attendance. If the arrangement does not conflict with fire prevention ordinances, it is desirable to have the heater when in the schoolroom, at the end nearest the door.

The smoke pipe arrangement shown on plan No. 2 would be unsatisfactory where bituminous coal must be burned, and a greater length of heated vent flue would be desirable.

If a horizontal screened top is used on the heater, there will be a tendency for debris and dust to enter the space between the heater and the encasement, and difficulty in removing this foreign matter will follow. When such a top is used, therefore, the encasement should be open all around, say, 12 in. above the floor, and the cold air should be brought in above this point, and deflected, as shown on the Chicago heater drawing (plan No. 6). Such an arrangement is conducive to heating rather than to ventilation, however, as a large part of the air handled must be recirculated, with a slight reduction in the amount of fresh air. The arrangement shown for the Toledo heater (plan No. 4) with its elbow above, permits the encasement to begin at the floor, and all air heated except from the outside of the casing, must be fresh air, when the damper provided for recirculation is closed.

The Boston separately-fired stack heater is undoubtedly more effective than the combined chimney-vent flue as it provides for ventilation regardless of heating, but the separate heater involves considerable extra labor and fuel. The combined arrangement of vent flue and smoke pipe is capable of considerable variation in detail without materially affecting the results, but the desirable ends to attain are the longest possible column of heated vent flue, the least possible friction; and ample area for air passage.

The foul air and smoke outlet should always be well above the level of the ridge, and care must be taken that the outlet is not prejudiced by wind eddies from nearby higher buildings. The outlet cowl should be of the simplest possible type, that shown for the Chicago heater having proven entirely practicable. Experience and tests indicate that so long as rain and snow are kept out, the nearer the flue cowl approaches an open top, the better will be the results. Considerable difference in size between the Chicago and the Boston flues will be noted, based on the intention of handling considerably more air at Boston.

HEATING TESTS WITH AND WITHOUT FANS.

Confirming the experiences of several of our correspondents that the upper parts of the rooms were excessively heated, tests were made in one of the Chicago schools, and indicated that with an outside temperature of 30° F., the inside temperatures were 63° at the floor and 118° at the ceiling. This indicates a need for better air distribution and movement within the portables.

Tests with fans indicated material improvement in the heat distribution, and considerable increase in the amount of heat given off by the heaters when the fan pressure was maintained on the cold air intake. The operation of fans within the room, tending to draw the heated air from the higher parts and to induce air currents throughout the room, was found feasible, and in our judgment is a justifiable procedure. The vertical shaft, slow-speed, ceiling type of fan, having two or four blades, such as are used in the New York subway, should

be very effective for our purposes in school rooms.

A test made in one of the Chicago buildings with heater arrangement as shown in plan No. 6, with a temperature outside 15° and inside temperature 70° at a point 5 ft. above the floor, and wind negligible, indicated that approximately 500 cu. ft. of air per minute was being delivered into the room through the inlet duct. From the fact that when this test was made the room was occupied by 40 pupils, and that the primary sense impression was good, we may conclude that there was a very large leakage of air from outside through the building construction.

An argument for the type of heater which has its encasement open into the room at the bottom as in plan No. 6, is that the very much higher rate of air movement which such a scheme of constant rotation of air induces, will more than compensate for the slightly less efficient fresh air heating function. When the encasement reaches to the floor, as in plan No. 4, and the recirculating damper is closed, the only recirculating effect in the room will be from the convection currents induced by the outside of the heater jacket, the smoke pipe, etc.

WATER PANS NEEDED TO PROVIDE NECESSARY MOISTURE.

Since the amount of fresh air furnished is rather limited, and the temperatures are rather high, tests have all indicated very low relative humidity as being the usual condition in stove heated rooms like these. The extremely dry condition of the interior woodwork, especially near the ceiling, confirms this. Every heater, therefore, should be provided with water pans, not down in the cold air, but near the top where the water may be heated, and the water should be maintained at a constant level, preferably by an automatic float valve in an auxiliary tank.

There has been complaint made of the tendency, in some portables, to become unduly warm in summer. For summer, the provision of an attic space will doubtless ensure a cooler room, and there should be windows or shutters opening into this space, so that in warm weather it must be kept freely vented, as suggested for the sub joist space. Cross-ventilation of the rooms should always be provided by high-shaded windows on the right side. The operation of the fans, especially if of the subway type, will very greatly alleviate the trouble. The experience of the United States Navy may be of some value in this connection, since a ship painted white is found to be considerably cooler in summer than one painted a dark color. It is suggested that a metal sheathing outside the wood construction may, because of the high conductivity of metal, cause the transmission of more heat from inside out in winter, and from outside in, in summer.

Bulletin on Operation of School-Heating Plants.

Under the title of "Fuel Saving in School Houses," the advisory engineering committee to the Massachusetts Fuel Administration has published a noteworthy bulletin (No. 6), prepared by Alfred S. Kellogg, a consulting engineer of Boston.

The bulletin starts out by saying that recent surveys, as well as data previously collected, show that there is a large and unnecessary waste of fuel in the school heating plants in Massachusetts. The principal causes of high coal consumption are as listed as due to the structural conditions of the buildings, the condition and equipment of the heating plant and the fuel, and, finally, the lack of supervision by the higher school authorities over the buildings, and the selection and instruction to janitors, teachers and classes, looking to the fullest co-operation in the saving of coal.

Under "structural conditions of the buildings," leaky windows are mentioned first. Metal weather strips are declared to be better than the usual double window. Attention, it is stated, should also be given to caulking the openings between the casings and sills. Next is mentioned a

shut-off damper for each vent flue, to prevent back drafts, especially at night. Whatever device is installed should be readily accessible and the janitor should be given explicit directions to close all such dampers within an hour after the close of school sessions during the heating season. In addition to the shut-off dampers it is recommended that fixed dampers of heavy design should be installed in every heat flue and every vent flue and rigidly fixed in position after being adjusted. They should be placed where they cannot be reached and changed by unauthorized persons.

Under "condition and equipment of heating plant," emphasis is laid on the necessity for discovering leaks in brick settings of all tubular boilers. Arrangements, it is stated, should be made wherever possible for recirculating the air through the classrooms, corridors, assembly halls and the steam heating stacks or warm air furnaces, so as to secure air rotation when the school is not in session.

Under "supervision by school authorities," a temperature of 65° is recommended for classrooms, with the suggestion that teachers and pupils be encouraged to wear sufficient clothing. It is further recommended to install in every classroom and assembly hall an accurate thermometer and to have a chart prepared similar to that shown herewith, for an hourly record of room temperatures. A pupil should be assigned to the task of keeping the record.

Humidity is recommended wherever possible. In furnace heating systems, says the bulletin, "this may be done by careful attention to keeping the water pan filled with water." (It is generally considered among heating engineers that this depends very much upon the location of the water pan). The bulletin goes on to say that a specially constructed water pan of copper made to fit the dome of the furnace and connected to the city water supply and controlled by a ball cock, "makes a most desirable humidifier." In this scheme provision should be made for a cleaning out pipe, as the water gets dirty in time.

Under instruction to janitors, following are some of the recommendations.

Boiler and furnace heating surfaces: Keep them clean by scraping and brushing at least twice a week where soft coal is burned and once a week in other plants.

Smoke pipe should be cleaned before the beginning of the heating season and oftener if soft coal is used.

Water in boilers should be changed at least once a year.

Gauge glass: The water level should be noted whenever you attend to the fire. Keep water gauge half full of water. More than half uses up the steam space; less than half may damage the heater.

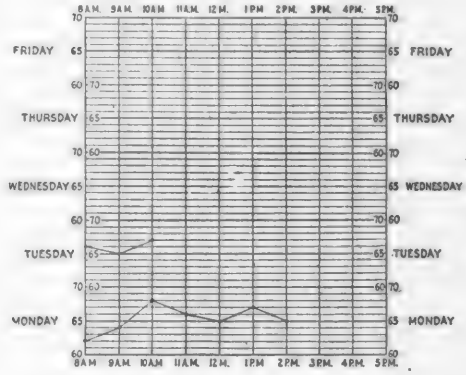
The following directions are given for rotating the air outside of school hours, **where a fan system is used:**

SUGGESTED TEMPERATURE RECORD

Room No. ..... Week beginning .....

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
8 A.M.	62	66			
9 "	64	65			
10 "	68	67			
11	66				
12 M.	65				
1 P.M.	67				
2	65				
3					
4					

SUGGESTED TEMPERATURE CHART



FORMS SUGGESTED BY ADVISORY ENGINEERING COMMITTEE TO MASSACHUSETTS FUEL ADMINISTRATION.

In the morning, run the fan, taking the air from indoors until the rooms reach the desired temperature. This takes about 20 or 30 minutes. At the same time steam must be on the fan heater and the by-pass or mixing dampers must be closed. When school begins, close the recirculating openings and open the fresh air windows. Run the fan as during the school sessions for an hour after the close of the school for the day, as it is much more economical to flush out after school than before school the next morning. Then close up cold air windows and the classroom vent opening for the night and open the recirculating doors. In many buildings, with steam on the fan heater, the air will circulate by natural flow and keep the building reasonably warm all night.

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THE dream of the heating industry that some way might be found for gathering data and conducting tests on an extensive scale, free from any taint of bias or commercialism, has at last come true. Due primarily to the efforts of the heating engineers' society, but with the financial support of the trade generally, there is about to be established a Bureau of Research to be devoted exclusively to the study of, and the development of standards for, heating and ventilation. Everyone connected with the trade, whether manufacturer, engineer, or contractor has long felt the need of such basic data as the bureau proposes to secure. The growth of the industry has only served to emphasize this need. While other industries were becoming more and more standardized, it seemed as if heating and ventilation was in a class by itself and, perhaps, was affected by so many conditions that efforts to standardize it on a broad scale were almost hopeless. It was realized that the work was a tremendous undertaking that could only be handled with ample funds. While the manufacturers were always in a position to undertake it, if they could be brought together, the fact remained that any results to be really acceptable as standards had to come from sources that would be recognized as unimpeachable as regards bias or commercialism and bearing the stamp of authority. The solution of having an unprejudiced party like an engineering society undertake the work has always been apparent, but when the cost was considered it was dismissed as simply impracticable.

Such was the state of affairs when the brilliant idea was brought forward that the project be taken up by the heating engineers' society on the basis that the trade at large would furnish the funds and the society do the work. Doubting Thomases were frank to say that even that plan was foredoomed to failure and that the manufacturers could not be brought in as a body to support the movement.

All of that, however, is history now. The entire trade has risen to the occasion, the necessary funds are in hand, and it is now only a matter of weeks when we shall see the great work started which, it may be confidently expected, will place the industry of heating and ventilation on the same high engineering footing as is enjoyed by other important branches of engineering.

More than that, the mere fact that the industry has had the courage to commit itself to this work, has already had a wonderful reaction, first, in bringing home a new consciousness of the place that by right belongs to heating and ventilation as a profession, and second, in mixed feelings of admiration, envy and respect shown by similar lines which are now obliged to look on and see the heating industry, to use the vernacular, "beat them to it."

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

RESEARCH BUREAU SUCCESSFULLY LAUNCHED AT SOCIETY'S ANNUAL MEETING IN NEW YORK, JANUARY 28-30

With $10,000 cash pledges in hand for a Bureau of Research and the prospect of, perhaps, double that amount in the near future; with a present membership, including applications recently received, of over 1160 members; and with the prospect of an era of achievement during the next few years that will place heating and ventilation in the front ranks of the engineering professions, the American Society of Heating and Ventilating Engineers fittingly celebrated its silver anniversary at its annual meeting, held in New York, January 28-30. If its new programme was adopted without extended discussion, it was because acts speak louder than words, and these acts were so well planned and so thoroughly executed that little remained to be done but to ratify them with all the enthusiasm that wholehearted effort and successful achievement can inspire. As President Still stated in yielding his office to his successor, President-elect Timmis, the society has "arrived," and is on the crest of a wave that spells Advance with a capital A.

WALTER S. TIMMIS,
President American Society of Heating and Ventilating Engineers.

The sessions were held as usual in the Engineering Societies Building, and the large attendance gave the finishing touch to the rapid succession of events that have placed the society where it is to-day. The total registration was 251 members and guests.

While it is difficult to properly apportion the credit among those who have "put over", the society's ambitious programme it is certain that to President F. R. Still as the guiding head of the society and to Former President J. Irvine Lyle as the chairman of the Research Bureau fund campaign will be accorded a large share of the glory for their remarkable accomplishments.

Afternoon Session, January 28.

Following the appointment as tellers of Frank T. Chapman, C. A. Booth and J. A. Donnelly, President F. R. Still presented his address:

President's Address.

After greeting the members, President Still referred to the services rendered by the society to the various branches of the government.

"It was not long," he said, "before we were called upon to aid in solving many difficult problems, and it is a pleasure to reflect upon the splendid way in which everybody responded when called upon to do committee work or perform any other service for the society. Many momentous questions have arisen, requiring instant decision and quick action. On the other hand, many long journeys have been made and time spent making careful investigations, to be followed by days and weeks spent in making a thorough analysis of the problems and writing lengthy reports and recommendations. In every instance all these things were cheerfully done at the expense of the individuals selected for the task without a suggestion that it might be a hardship to do it."

President Still paid a warm tribute to the work of Secretary Obert whose duties, he said, had multiplied tremendously.

He then referred to the work of the committees, one of the most important of which was the Research Committee.

"This committee," he said, "has done an immense amount of hard work; the members have traveled extensively, held numerous meetings; have listed every concern and individual in the heating and ventilating business that could be located, have determined the invested capital of each concern from the mercantile ratings or from private sources, have card indexed all of them and assigned amounts to be contributed annually for five years for the founding and support of the 'Research Bureau."

He also made mention of the work of the "fuel conservation" committee. "To this committee," he said, "was referred the matter of fuel conservation at the solicitation of the Federal Fuel Administration. The members got to work promptly and submitted a very comprehensive report, which evidently had a material influence in shaping the plans of the Fuel Administration, judging from subsequent recommendations emanating from that department."

SERVICE TO NAVY AND OTHER GOVERNMENT DEPARTMENTS.

"The committee to co-operate with the U. S. Navy Department also has done some very creditable and praiseworthy work, under the chairmanship of Vice-President Walter S. Timmis, which has been gratefully acknowledged by the Navy Department, and as a result of which there will likely be some radical changes made in the method of heating and ventilating battleships and submarines in the future. The work of this committee is far from complete, however, and it should be continued indefinitely.

"Two committees on dehydration have been studying the question from two different angles, but with the single purpose of finding ways and means of preserving and saving food. This work has entailed a lot of investigation, experimentation, travel, correspondence and consultation, which it is to be hoped may ultimately lead to great economic good to the society, although there still remains a vast amount of work to be done and an intensive educational campaign promoted before the public will be ready to generally undertake this method of preserving its food supply, even under the most adverse conditions. The work of these committees should be continued until such time as it can be definitely settled whether or not further effort is worth

while. If the people had not been so prosperous during the period when food was so scarce, and at the same time had been compelled to pay the prevailing high prices, then undoubtedly dehydration would have met with more favorable consideration than it has received. But just so long as the American people have the money to spend, they will pay the price to get what they are accustomed to rather than to experiment with something new; furthermore, just so long as this condition prevails or there is any probability of food becoming cheaper, there is not, in my opinion, much to hope for in the ultimate popularity of this method of preserving or conserving food."

Speaking of his visit to various cities in connection with the formation of new chapters he said:

"I cannot answer for the experience of the others, but speaking of my own, this trip was quite the most interesting I ever made, and the effect it apparently had in arousing greater interest in the affairs of the society was most astonishing and gratifying." He recommended that it be incumbent upon least one of the future officers to visit each chapter once every year, and that the expense so incurred be hereafter provided for in the budget for conducting the affairs of the society.

Another impression which, he said, received as the result of his trip was the necessity to provide for a new class of membership, to be known by some such title as "apprentice membership," to be open especially to young employees of the members who could gain valuable information from the chapter meetings and who would add considerable zest to the meetings by the part they would inevitably take in the proceedings.

Continuing, he said:

"This society can do some constructive work that will be highly appreciated by architects, engineers, manufacturers and contractors by devising a standard form of guaranty for the many systems of heating and ventilating varying types of buildings. This has been needed for years, and should be delayed no longer than is necessary to perfect the forms.

NEW COMMITTEES NEEDED.

"A standing committee should be appointed to study conservation of national resources and be prepared to act with other organizations for a similar purpose. A part of the work to be undertaken by such a committee would be the construction of buildings to better insulate them against extremes of heat and cold, to promote rules for properly firing furnaces, to handle ashes and keep down dust, to devise methods for instructing the public in conservation, to inspect and pass on the acceptability of the many heating and ventilating devices offered for sale, to prevent the public being swindled.

"Another important standing committee, more important now than heretofore, is a committee on legislation. This is about the only business which has not been regulated by law. The tendency of the times is to regulate everything we do. Spasmodic efforts have been made in some of the States to pass inspection laws governing the plans and the operation of heating and ventilating plants, which goes to prove that this society should be prepared to have a voice in the framing of any of the laws that are ultimately bound to come.

"The standard form for ventilation laws which were adopted by the society some years ago should be revised to conform with present-day standards, in the light of newer discoveries since those rules were adopted. No other authorities need hardly be consulted than the proceedings of this society to find what is the latest and best thought in this respect, and what should be changed, eliminated or added.

Another subject which should have

early attention and be backed by definite recommendations of this society is the adoption of the wet-bulb thermometer instead of the dry bulb to define a comfortable temperature."

The report of the council reviewed the war work done by several of the committees and of the appreciation expressed by the Navy Department, the Bureau of Mines and the Department of Agriculture for the assistance rendered. In the case of the Bureau of Mines the proposed rules for fuel rationing drawn up by the society's committee were found to be especially useful, but fortunately the close of the war made it unnecessary to take any drastic action toward limiting the coal supply. The work of the Department of Agriculture, it was stated, relating to the drying of fruits and vegetables had advanced to the point where this process could be established as one of the economic industries of the country.

Seventeen committees, stated the report, have been at work during the year.

The council recommended retaining the present name of the society with the omission in the title of the word, "The."

SECRETARY'S REPORT.

The report of Secretary C. W. Obert made a remarkable showing in the increase of the society's membership during the year. No less than 119 new members were added to the roll, while 73 candidates for membership are now posted for membership and, since that time 76 additional applications have been received. There were 850 members at the beginning of the year so that with the new members and the applications on hand the total membership roll is now well over the 1000 mark. 64 members are on the society's honor roll.

The receipts for the year were $7,215 which, with the balance on hand, made a total of $11,231. The disbursements were $11,881, the high figure being due largely to the excessive cost of paper and printing. Although the year's operations ran somewhat above the income, the society still has a reserve fund in the treasury of $3,966.41. The inventory of the society's assets showed a membership equity of $13.56 per member.

TRIBUTES TO PROFESSORS KENT AND CARPENTER.

President Still referred to the recent deaths of two of the society's oldest and most honored members, Professor William Kent and Professor Rolla C. Carpenter.

Albert A. Cary, one of the charter members of the society, presented some interesting reminiscences of both men, recounting early events in the history of the society in which they figured. He characterized Professor Kent as a man of the highest sense of honor who exemplified in his own career the strict code he always advocated for the engineering profession. Of Professor Carpenter, he said he was a man of whom he had never heard an ill word spoken, while his original work in many fields and his many valuable contributions to the art stamped him as one of the most remarkable men of his time.

Following Mr. Cary's eulogistic remarks it was voted to appoint a committee to draft suitable resolutions on the deaths of Professors Kent and Carpenter. The chair appointed on this committee Albert A. Cary, C. L. Riley and W. S. Timmis.

REPORT ON RESEARCH BUREAU.

The big event of the meeting was then brought forward in the report of the Committee on Research Bureau. This was presented by Chairman J. I. Lyle, who, as President Still said, has done a vast amount of work in organ-

izing and carrying through the campaign.

At the present time, he said, 350 subscriptions are in hand, totaling $6,981. Reports received by telegraph brought this amount up to $8,951. There was no doubt, he said, that the committee's minimum goal of $10,000 per year for the research bureau would be greatly exceeded. He announced later that subscriptions for $1,000 each for five years had been received from the Buffalo Forge Company, United States Radiator Corporation, American Blower Company, Kewanee Boiler Company and the B. F. Sturtevant Company.

The report reviewed the plan for the establishment of the bureau which had its inception during the fall of 1916 at a meeting of the Michigan Chapter held at the University of Michigan. It was first proposed to establish a fellowship in some university but before long the idea of a research bureau took form and was advanced by committees headed by George W. Barr and Perry West.

Early in 1918 the matter was referred to a committee headed by Former President J. I. Lyle. This committee investigated the institutions that might be utilized in establishing the Bureau of Research, and, at the invitation of O. P. Hood of the Bureau of Mines, a visit was made to the Bureau of Mines building in Pittsburgh. As a result of the visit it was decided that if the necessary funds could be raised the Bureau of Research should be located at the Bureau of Mines.

In addition to the offer of suitable office space, the Bureau of Mines was ready to put at the disposal of the Research Bureau the use of its physical and chemical research laboratories, the use of special laboratory connection with the power house, service in the form of steam at high or low pressure, electric current, direct or alternating; water, hot or cold; and gas; and, finally, the use of such instruments as were available. In this connection the report stated that the Taylor Instrument Companies of Rochester, N. Y., had generously offered to furnish all the thermometers and similar instruments that might be needed.

For the future research activities of the society, the committee recommended the following procedure:

1. That the Research Bureau be a standing committee consisting of 15 members, each serving for three years, five retiring each year.

2. That the council shall nominate each year five members to fill pending vacancies, although provision was made for separate nominations by any ten members. The election of such committeemen shall conform to the rules for the election of officers. All vacancies are to be filled by the council.

BUREAU OF MINES BUILDING IN PITTSBURGH WHERE THE HEATING ENGINEERS' BUREAU OF RESEARCH WILL BE LOCATED.

3. It was provided that the Research Bureau shall be divided into various sub-committees.

4. The bureau's activities are to include an investigation of the needs for research in any particular subject and if sufficient to warrant consideration from the standpoint of pure engineering shall appoint a sub-committee to (1) collect all existing data and records; (2) examine records and reports on actual needs for further work; (3) report on all available laboratories of colleges or other institutions that might be utilized; (4) make definite suggestions for procedure.

Where research work is found necessary and course of procedure is obvious, the Research Bureau is to negotiate with laboratories or colleges, as offered, or order work handled by director of bureau.

If sufficient existing data appear to be available for analysis by committee, it is to present a synopsis of the data at the next regular meeting of the society.

All conclusive data, whether originating through the Research Bureau or the committee, or elsewhere, to be submitted to the next regular meeting of the society.

Finally the committee is to report on questions of finances, ethics and commercialism.

Rules were offered for the organization of the Research Committee, including the formation of a sub-committee, to be known as the Research Executive Committee, made up of four members and the chairman. The executive committee will employ the director and such assistants as may be required, and shall also determine the rotation in which the various subjects shall be investigated by the Bureau of Research.

All acts, findings or reports of the sub-committee as well as of the Research Committee itself, will be subject to the approval of the council and, as far as its engineering reports are concerned, to the society.

Each chapter is to appoint a research soliciting committee to conduct a campaign every year for funds for the bureau.

The activities of the Research Bureau are to be sent to all members of the society and to all subscribers to the Research Bureau Fund.

The report was accepted with much enthusiasm and the various recommendations made by the committee for organizing and carrying on the bureau were unanimously adopted. A vote of thanks was given to the members of the committee and to others who assisted in the work.

O. P. Hood, chief mechanical engineer of the Bureau of Mines, was present and gave the members an assurance of the desire of the bureau to co-operate with the society in this important work. The bureau, he said, has been built at a cost of $500,000. It is proposed to allot a portion of the laboratory section to the uses of the research bureau.

While Mr. Hood was speaking moving pictures were displayed, showing the staff of the bureau at work.

George A. Orrok, representing a committee of the American Society of Mechanical Engineers appointed to investigate the problem of heat transfer in general, addressed the meeting, and asked its co-operation, through the research bureau, in securing data on the value of insulating materials and materials used in building construction. The mechanical engineers' committee, he stated, was also gathering data on automobile and airplane radiators. He said we have yet to develop a general law covering the transfer of heat from one body to another.

The balance of the session was occupied mainly by committee reports. A letter was read from Harry A. Garfield, formerly United States Fuel Administrator, expressing his appreciation of the work of the committee which

drew up a plan for limiting the use of coal in residences. It was not necessary, he said, to carry out the plan as outlined. The thanks of the Fuel Administration were also extended to those who had volunteered to act as instructors at the administration's fuel saving stations, in Philadelphia, and elsewhere.

For the committee to confer with the National District Heating Association, Mr. Lyle reported that it was hoped to arrange a joint meeting of the district heating engineers and the heating engineers' society, next summer.

For the committee to co-operate with the United States Navy Department, Walter S. Timmis stated that the committee's report was confidential, but that after peace is declared the committee expects to make a report to the society on its activities. President Still stated that the commitee's work in connection with heating and humidifying of battleships and submarines had been of great importance and help to the Navy Department and this has been duly acknowledged by the department.

A lengthy report was presented by Professor John R. Allen, chairman, on a standard method of testing radiators. It was not read but was ordered published.

The report of the tellers showed the following result of the election:

NEW OFFICERS.

President, Walter S. Timmis, New York.

First Vice-President, E. Vernon Hill, Chicago.

Second Vice-President, Dr. Milton W. Franklin, Philadelphia.

Treasurer, Homer Addams, New York.

Members of Council: Howard H. Fielding, Denver, Colo.; Harry E. Gerrish, Minneapolis, Minn.; George B. Nichols, Albany, N. Y.; Frank G. Phegley, Cleveland, O.; Fred W. Powers, Chicago; R. W. Pryor, Jr., New York; Champlain L. Riley, New York; and F. R. Still, Detroit.

It was voted to grant charters to the new chapters established in Buffalo, under the name of the Western New York Chapter, and in Pittsburgh, under the name of the Western Pennsylvania Chapter. The new chapter in St. Louis will operate under a charter granted several years ago when a previous effort was made to organize a chapter in the St. Louis district.

Evening Session, January 28.

The Tuesday evening session was opened with a paper on "Experiments in Air Conditioning the House," by E. R. Hayhurst, M. D.

Experiments in Air Conditioning the House.

This paper reported an attempt made to determine whether the average-sized residence could be air-conditioned, especially in regard to maintaining a proper humidity, comfortable temperature, and healthful atmosphere during the winter time and in a manner to be practical and feasible for the small householder. The residence used in the experiments was that of the author, in Columbus, O., and was heated by a warm-air furnace. A Herr humidifying apparatus was installed to supply the necessary moisture being placed in an opening near the top of the furnace housing so that the water spray continually played on the top of the dome of the firebox within. There were also gas grates in some of the rooms, as well as gas heaters and one overhead gas-heating plate, all burning natural gas.

Five sets of experiments were made: one in rooms heated by direct gas-heating appliances, one with the hot-air furnace, one with cool rooms, one with artificial humidification, using the hot-air furnace, and one with artificial humidification using both the hot-air furnace and direct gas heating.

The desired humidity was obtained

in each case. When naked gas flames were used they gave the necessary humidity (from 40% to 60%) without additional humidification. It was also brought out that maintaining lower temperatures indoors with increased humidity, gave the desired comfort but did not lessen the consumption of coal, as heat was being used at the furnace to evaporate the water. Incidentally it was found that the use of an electric fan to force air through the heater served to increase its efficiency.

On the whole the scheme was found practicable for household use. The author recommended, however, that in such a system, arrangement be made to recirculate the air through the furnace.

This was followed by a paper by Perry West on "Air Washing and Humidification for School Buildings."

Air Washing and Humidification for School Buildings.

Mr. West discussed this subject under the headings of (A) What are the necessities of air washing and humidification in our schools? (B) To what degree do commercial air washers and humidifiers meet these necessities? and (C) What is the cost of air washing and humidification? He quoted from reports of the Chicago Commission on Ventilation, the New York State Commission on Ventilation, and from data collected and presented to the School Board of Newark, N. J. as well as from other reports, incidentally answering many of the points brought out by opponents of modern heating and ventilating practice. Mr. West showed that the use of air washers are a necessity of the first importance. He also supported the contention that commercial air washers and humidifiers do meet these necessities when properly designed.

On the cost of air washing and humidification, Mr. West took, as an example, a school designed for 1500 pupils, requiring 45,000 cu. ft. of air per minute. Figuring the cost of the highest grade air washer at $3,000, he presented the following estimate, based on the washer being in operation during the four winter months:

Interest and depreciation @ 10%..	$300.00
21 tons of coal @ $6.00 per ton	126.00
Electric current to operate motor..	80.00
	$506.00
Deduction for saving in coal by lower temperatures.....	86.00
	$420.00

This, he said, amounted to a cost of about 28c. per pupil per year. The first cost of the apparatus is about 6% of the usual cost of the heating and ventilating equipment and about 1% of the total cost of the building.

Mr. West stated very frankly that in Newark the improved conditions that should be expected are not as yet being realized, but he said this was also true of ventilation. Of the $75,000 spent annually in Newark to supply and condition air in school buildings, he felt that not more than 50% of the value received for this expenditure was being realized.

In discussing the matter of air washing, it was pointed out by one speaker that the water should not be used indefinitely, as it soon becomes surcharged with the impurities taken from the air. If recirculated to any extent, some means should be taken to sterilize the water. He expressed the hope that the society's new Research Bureau would investigate the question of the injurious effects of the products of respiration. Regarding the idea of flushing the school rooms with cool air at intervals, he stated that Professor J. H. Kinealy, of St. Louis, has recently perfected an appliance for doing this thing automatically as the classes change.

Dr. Wolff Freudenthal, the well-known French physician, was then in-

ANNUAL DINNER OF AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, HELD AT THE HOTEL McALPIN, JANUARY 30.

troduced and held the close attention of those present as he told of what actually takes place in the human body in breathing moistened and dry air. He said the function of the nasal organs is not only to catch germs, but to properly heat the air before it passes to the lungs and to give it the proper moisture. The mucous secretions serve to furnish this moisture so that if excessively dry air is continually breathed, the mucous secretions become exhausted and the membrane becomes dry, in that way exposing the body to disease. He argued from this that it was a dangerous practice to heat a house without furnishing the requisite humidity.

Other speakers dwelt on the fact that in many schools and other buildings very often the mechanical ventilating equipment will be found not in operation. In one case, said C. A. Booth, he had found instructions that the fans were not to be operated unless the outdoor temperature went below 20° F. He said the split system was partly to blame for this condition.

Another speaker stated that that was the best argument he had ever heard for the abandonment of the split system and expressed his belief that the single system of heating entirely by indirect means was the best method.

Mr. Weinshank took sharp issue with this stand, quoting Professor Carpenter and others as to the advantages of the split system in forming a curtain of warm air in front of the windows, etc. He said that the answer to the failure of janitors and others to operate the plant was the law in Indiana which makes the principal responsible for the operation of the heating and ventilating system.

The session closed with the presentation of a paper on "The Argument Concerning Mechanical and Natural Ventilation," by Dr. E. Vernon Hill. (This paper was published, practically in full, in THE HEATING AND VENTILATING MAGAZINE for November, 1918).

Afternoon Session, January 29.

Before the regular programme was taken up some results were given by Frank N. Speller of the National Tube Co., Pittsburgh, of tests on deoxidization of hot water pipes during the past year, at the Irene Kauffman Settlement plant in that city.

The regular programme was then resumed, the first paper being on "Air Duct Design," by Leo Kraft.

Air Duct Design.

Mr. Kraft presented a method of designing ducts which he described as a short, if not shorter, than most empirical methods. The necessary arbitrary assumptions are all made at the start, and these assumptions are of such a nature that they affect the operation of the system as a whole and not the individual parts of the system. In addition to the formulas given, diagrams were included enabling one to solve these equations graphically, entirely without calculations.

In the discussion L. A. Harding stated that the use of Mr. Kraft's charts will not give the correct delivery through branch ducts without the use of volume dampers. He said the static method is only adapted to straight ducts. He thought, therefore, that some modification should be made in the paper to take care of this point.

The next speaker was F. J. Hoxie, engineer and special inspector for the Associated Factory Mutual Insurance Companies of Boston, who supplemented his paper on "Arrangement of Heating Pipes an Important Factor in Decay of Factory Roofs," with a large number of stereopticon slides illustrating many varieties of decay and the causes of fungus growth and methods of rectifying the conditions found.

Arrangement of Heating Pipes an Important Factor in Decay of Factory Roofs.

The author stated that the rapid destruction of saw-tooth weave shed roofs by decay within the last few years has progressed to an alarming extent. He showed that a considerable part of this destruction can be stopped by changing the arrangement of the heating pipes. The primary cause of the decay, he said, is doubtless the use of artificially humidified air in buildings in which relative humidity of from 70% to 80% at a temperature of 70° F. is maintained the year round. Several examples were illustrated of decayed roofs. Details of construction, such as thin metal ventilators, metal roof drains, skylights and windows which radiate more heat than other parts of the roof and thereby keep the air in their vicinity cooler than in other parts of the building, will accelerate the destruction.

Among the cures suggested were increasing the insulation, also the use of steam pipe covering for drain pipes, covers of heavy plank for ventilator openings, and increasing the insulation of the roof. It may sometimes be found more convenient, he said, to increase the amount of heat rather than to reduce the loss by increasing the insulation.

Sheating on the inside of the roofs, with an air space, to increase the heat insulation and to prevent sweating, results in the propogation of wood-rotting fungi in the air space.

Moisture carried by air currents set up by the heating pipes is next in importance to the dew-point of the air in causing rot in roofs. The suggested remedy for this was to locate the heating pipes close to the ceiling to prevent upward currents of moisture-carrying air.

Mr. Hoxie's lecture was received with the greatest interest, being something quite new to come into the proceedings. In his supplementary remarks he emphasized the fact that the decay of wood is due to the relative humidity of the surrounding air. Heating the air to 115° F. will kill all fungi. Moreover no fungus can grow in dry wood. Another point brought out was that wood should never be encased in metal.

W. S. Timmis told of a case in the McGraw Building in New York where wood flooring was laid on screeds on a new concrete floor. In the office where linoleum covered the floor there was dry rot which was attributable to the fact that the moisture in the concrete could not find an outlet.

It was stated by another speaker that 75% of the industrial buildings built in this country during the past few years have wooden roofs so that this matter is one of immediate interest as a heating problem and a large one.

Mr. Bahnson suggested that air circulation might be used to good advantage in removing the excess moisture, and would be better than excessive heating with steam pipes.

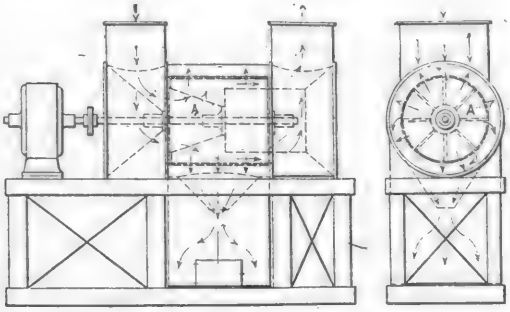
In response to this and other questions Mr. Hoxie stated, that with a hot air system there must be supplied a sufficient amount of moisture and the problem was to prevent moisture from accumulating under the cold roof. He believed a combination of the two systems was the best. Regarding creosoting the wood or using other preservatives, Mr. Hoxie said that the character of the work being done in the mill had to be considered and that the dripping of moisture from creosoted roofs onto fabrics soon taught mill owners to avoid using creosote unless provision had been made to take care of the condensation.

The concluding paper was on "Dust Determinations in Air and Gases," presented by E. R. Knowles.

Dust Separators.

This paper was supplementary to one presented by Mr. Knowles at the

society's last annual meeting. At that meeting he described the three dominant systems of dust separation as (1) the bag or filter system, (2) the electrical precipitation system, and (3) the centrifugal dust separating system. These systems were also typically illustrated in the previous paper. He has now brought out the improved mechanism and methods that have been developed with the bag or filter system and with the centrifugal system.



DETAILS OF THE KNOWLES CENTRIFUGAL DUST SEPARATOR.

The improved bag or filter systems referred to are the American suction dust filter, the U. S. automatic fine dust suction filter, the Allis-Chalmers dust collector and the Perfecto filter. Improved forms of the centrifugal system described are the Buffalo centrifugal scrubber and the Knowles centrifugal dust separator, the latter being the author's own design. This system, he showed, can be applied to any standard centrifugal fan, dispensing with the necessity of a special fan design, and requiring but small alterations in the fan housing, bearings and drive.

In the Knowles system the air or gasses and dust content are drawn through the inlet into the fan and, by the centrifugal action of the fan, the gases and dust particles are forced radially at high velocity against the perforated circumferential portions of the fan blades. The housing and tank form a closed box and consequently the gases in the housing and tank are practically at the same pressure as in the interior of the fan. The velocity of the gases in a radial direction is checked, as none can pass through the perforations in the circumferential portions of the fan blades nor through the openings between the fan blades.

The direction of the flow of the gases is changed and they flow, freed from their dust content, along the inner surface of the perforated circumferential portions and out through openings into and through the outlet.

The dust particles, being free to move in the gases, by virtue of the direction and velocity imparted to them by the fan blades, continue in their radial direction and pass through the perforations in, and the openings between the circumferential portions of the fan blades, into the space between the housing and the fan and thence fall or are driven into the collecting tank or bin.

This form of centrifugal separator the author stated, will extract, dry 85% to 90% of the dust content of the air or gases. By providing the outlet with a filter bag system, a total dust extraction, dry, of 100% can be obtained. Water sprays may be provided for use in case it is desired to wet the dust, the excess water passing out of the collecting bin through an overflow.

A communication was presented from the New York State Department of Labor asking the society to answer the question as to whether air has to be heated to provide ventilation. It was taken as a query on the general proposition of window ventilation, and it was voted to appoint a committee to draw up a suitable reply. The committee consists of Messrs. Hallett, Allen and Claffey.

Before the session was brought to a close, President Still called upon William H. Driscoll and Walter S. Timmis to relate some of their experiences in connection with the build-

ing of the great government powder plant at Nitro, W. Va. The heating and ventilating plant was designed by George W. Hubbard, president of the Illinois Chapter. William H. Driscoll was in charge of the installation, acting for the Thompson-Starrett Company and Walter S. Timmis had charge of the purchasing of a large part of the equipment.

Both speakers gave a running description of the job which was one of the largest of its kind ever tackled. Mr. Timmis stated that his purchases alone for the plant ran up to $12,000,000. He declared that the biggest thing about Nitro was William H. Driscoll, who, he said, had made an enviable reputation for himself in his handling of this monumental heating and power installation.

Mr. Timmis then made a number of motions designed to carry out the recommendations contained in the president's address. On his motion it was voted to prepare an amendment to the constitution, making provision for "apprentice membership." It was voted to revise the constitution and to prepare a standard form of chapter constitution. It was voted to appoint a committee on conservation of national resources. Finally it was voted to appoint a committee on legislation, "not to influence it," as President Still said. "but to watch it." Mr. Still spoke of the legislation that was being proposed in more than one State to provide for the inspection of heating plants and the licensing of heating engineers. He said such legislation is bound to come and that the society should see to it that the proposed laws were properly framed. He also commented on the fact that up to the present time the heating industry was the only one he knew of that had not been subjected to restrictive legislation.

Evening Session, January 29.

The Wednesday evening session was given up almost wholly to a discussion of the society's boiler code for testing and rating low-pressure heating boilers.

In the absence of Homer Addams, chairman of the boiler code committee, the committee's report was presented by Professor John R. Allen. The report was a revision of the entire code, the principal feature being a provision for a continuous firing method of testing, instead of only the new firing method as was specified in the present code. A new clause was also inserted providing for a duration of the test to cover two firing periods, each twelve hours in length and the length of the test to be always some multiple of the period of firing.

It was brought out in the discussion that in the case of magazine-feed boilers a continuous firing method of testing was essential.

On motion the code was unanimously adopted as the 1919 code of the society.

The session concluded with a report on schoolhouse standards presented by Frank Irving Cooper, chairman.

Mr. Cooper presented an analysis of the building plans of 141 school buildings located in various parts of the United States which showed that an average of 50% of the floor area was devoted to strictly educational purposes, 12% to administration and from 3% to 12% to heating and ventilating equipment. He showed a further analysis of the space occupied by such portions of the heating equipment as apparatus, fanroom, coal space, boilers and ashes. He quoted C. B. J. Snyder, architect for the New York City Department of Education, as estimating that 18% would be a fair proportion of space to be allotted to the heating and ventilating equipment. In Chicago the average is 7%.

In the discussion Mr. Hallett advocated provision for an abundance of coal space. Mr. Williams said that the society should fix as a minimum percentage of space for the heating plant and take a stand with the architects on the proposition.

The report was accepted.

Morning Session, January 30.

Thursday morning was given over to a session on temperature control. F. A. DeBoos contributed a paper on "Fuel Conservation by Means of Automatic Temperature Regulation," which was read by Secretary Obert.

Fuel Conservation by Means of Automatic Temperature Regulation.

This paper was written while the war was still on, and while the rigid economy in the use of fuel, contemplated by the author, is no longer necessary, the argument for the elimination of wasteful practices in this regard is in no way lessened. Mr. De Boos stated that in any heating system, properly designed and installed, two facts stand out prominently. One is that the plant must be of sufficient capacity to heat the building adequately in the most severe winter conditions ordinarily encountered; the other is that some rooms and some parts of the building are always slower and more difficult to heat than others. Referring to the first point, owing to the fact that the plant must be very much over the capacity required during the average winter conditions, it means that during the greater part of the heating season, in hand or manually-controlled plants, the rooms are heated to a higher temperature than is required, windows are opened for relief and much fuel is wasted in consequence.

Mr. De Boos took the ground that the opening of windows is not usually due to "fresh-air" principles, but to overheating. When windows are opened, he states, the radiator valves are, in general, never shut off, thus causing increased heat loss.

Mr. De Boos gave a number of instances showing the savings effected in different types of buildings by automatic temperature control, adding the statement that the leading heat regulation companies have so improved their apparatus, in the past few years especially, that, with the modern system, the upkeep expense will not average over 2% to 5% per year as a maximum. He concluded with the following suggestions for applying automatic temperature control systems:

1. Equip all heat sources with automatic control; radiators in hallways and vestibules are hardly ever shut off by hand and their peculiar location under this condition makes them great fuel wasters.

2. Control direct heating systems, as well as fan or mechanical blast systems of heating; control on one is fully as important as on the other. It is a mistaken idea to apply control to mechanical systems only.

3. Where ventilation systems are used, ararnge switch control of fresh air and ventilator dampers so the heat may be retained in the buildings at night; where local conditions permit, return air openings should be provided so the air may be recirculated; provide shut-off dampers in ducts leading to gymnasiums and auditoriums, or other parts of the buildings so that heat may be shut off these rooms when not in use.

4. Control risers by placing diaphragm valves with switch lines to a convenient point so that radiation may be shut off in any part of the building not being used; with most schools, it is necessary to heat the entire building, when at night it may be only the auditorium or gymnasium that is to be used.

5. The air mains for the temperature controlling system may be arranged in circuits so that the heat may be cut off various parts of the building by simply shutting off the air from the thermostats; this has some advantage over riser control in that it is not necessary to make special runs of the steam mains.

6. Where thermostatic control is used the radiation units may be increased considerably in size, necessi-

tating fewer units, risers, etc.; this arrangement will often effect sufficient saving to pay for a considerable part of the control apparatus—it is particularly suitable for factory installations where extremely close control of the temperature is not so essential.

7. Special control devices in factories not only afford considerable fuel saving but result in a better product in that it permits same to be made under more uniform conditions; it also avoids loss of product due to excessive temperatures.

In the discussion Mr. Williams spoke of the need of regulating the janitors who are apt to operate the system in much the same way on warm days as they do on cold days. Mr. Still said that the sooner the heating industry makes use of the wet-bulb thermometer as a standard for fixing indoor conditions, the better it would be for the progress of the art. He said it had been brought out that a variation in the wet-bulb temperature with a fixed dry-bulb temperature quickly affected the comfort conditions in a room, but that with a fixed wet-bulb temperature, it was possible to vary the dry-bulb temperature as much as ten degrees without seriously altering the comfort.

He said however that the use of the wet-bulb thermometer as a standard would mean that the temperature control devices now on the market would need to be practically remodeled to meet the new conditions.

The report was then presented of the Committee on Automatic Heat Control. This was published in full in THE HEATING AND VENTILATING MAGAZINE for October, 1918.

Prof. John R. Allen presented a paper on "A Test of the Conductivity of Window Shades."

A Test of the Conductivity of Window Shades.

This test was made to determine the relative amounts of heat transmission through a single strength window glass, close fitting, with stops on both sides, first without window shades and, second, with window shades pulled down in front of the window. For the purpose of the test a specially-prepared cubical box, open on one side, was used, and a quantity of ice was placed inside the box. The results showed that the saving in heat transmission by the use of a single inside curtain was 19.2%, by an outside curtain, 28.7, and by both curtains, 42.7%.

A topic was then presented on "Notes on Capacity of Automatic Roof Ventilators." Some test data presented on various types, based on information furnished by the manufacturers. Those described were the Anchor, manufactured by Meurer Bros. Co., Brooklyn; the Royal, made by the Royal Ventilator Co., Philadelphia; the Globe made by the Globe Ventilator Co., Troy, N. Y.; and the Bicalky, made by the Bicalky Fan Co., Buffalo, N. Y.

Major J. W. H. Myrick spoke of the fact that almost any results may be obtained with roof ventilators as the conditions are so varied and constantly changing. He described the characteristics of a number of types and called attention to their advantages and disadvantages. He said a revolving type is always to be preferred to a stationary type.

E. A. Scott told of confidential tests made by the Quartermaster's Department of the War Department and expressed the hope that the society would undertake a series of tests under as nearly uniform conditions as possible so that installers of stationary ventilators could have something besides manufacturers' data to go on.

It was also brought out that stationary ventilators are being used to an increasing extent, especially in Massachusetts, as a substitute for exhaust

fans on account of the present high coal prices.

Afternoon Session, January 30.

The final session was opened with a paper by Konrad Meier on "Limiting the Fuel for Domestic Heating." Before presenting the paper Mr. Obert called attention to the fact that it was written some time before the signing of the armistice with Germany.

Limiting the Fuel for Domestic Heating.

In this paper Mr. Meier, who will be remembered as in active practice in New York for several years, presented the rules in effect in Switzerland, where he is now located, regarding the distribution of fuel. He made comparisons between the operation of the rules in Zurich which, he said, corresponded in general with such localities as the eastern cities of the United States, showing how much more heating is considered necessary in this country than in Switzerland. He gave in detail the various sources of at least partially preventable waste. His paper indicated that a lower limit might be possible in the fuel rations for the United States than those which had been proposed so far.

Professor Allen stated that in cold climates more care is taken in houses to insulate them during the winter months against loss of heat. As a result, in such localities as Minneapolis, where temperatures of 30 degrees below zero are not uncommon, the heating plants installed in residences are actually of smaller capacity than those used, for instance, in Detroit. He thought this would explain, to some extent, the wide divergence in the fuel consumption in this country and abroad.

Mr. William Ehrlich then presented his paper on "Engineering Economics of Heating," which appears, practically in full, on other pages of this issue.

G. B. Nichols spoke of the human element factor which makes it extremely difficult to give any definite average for the fuel consumption. Mr. Ehrlich stated in reply that the paper was intended to furnish a means for judging what a given plant should do. If the coal consumption figures ran materially above those given by the tables it would mean that there was waste and inefficiency in that plant, and an investigation should be made. If, on the other hand, the operation figures ran close to or below those given, it would mean efficient operation.

The final paper on the programme was on "By-Product Coke," by William T. Harms.

By-Product Coke.

By-product coke, the author stated, represents a fuel distinctly different in character from gas-house coke, being lower in volatile matter, higher in fixed carbon, and very much harder and denser in structure. When burned in the usual house heating boiler or hot air furnace under proper conditions, it acts in a manner similar to anthracite coal. Inasmuch as practically all of the valuable constituents of the coal are extracted, separated and saved, to serve the vital needs of peace and war, we have here true coal conservation—in fact the writer stated that in the not too far future all or practically all bituminous coals used for domestic heating will be coked. The author then presented a description of the method of manufacture of coke in by-product ovens.

The buckwheat and pea sizes of coke are used to a considerable extent in house heating boilers and furnaces designed with magazine feeds with excellent results, but owing to the fact that coke is lighter than anthracite, the firing periods are somewhat shorter, or if it be desired to use this fuel exclusively, a boiler about one size larger than required for anthracite coal should be selected. This also holds good in the case of the

larger sizes of coke when burned in the usual surface feed boiler or furnace, a deep fire pot being desirable. Because of the lightness of coke a deeper bed must be maintained, which also avoids clinkering troubles to a great extent by avoiding high local temperatures, and it presents more stable combustion conditions, as well as permitting better regulation of room temperature because of lengthened firing periods.

It has been found beneficial to admit a portion of the air supplied for combustion, above the fire bed, through the check draft usually supplied in the fire door of a boiler or furnace, to assist in burning the carbon monoxide. Quite a number of flue gas determinations made by the writer with this damper open and closed seems to substantiate this.

The smoke pipe damper should be opened wide just before shaking the grates for the removal of ashes, after which the fire should be replenished with a fresh supply of coke, and dampers closed about one half. When the gas appears to be burning freely on the surface of the fuel bed, all subsequent regulation should be obtained by means of the check draft in the smoke pipe or boiler breeching, rather than by the volume damper. This of course presupposes the existence of a normal draft; should the draft be less than normal, the volume damper should remain wide open at all times. It is a well known fact that coke can be burned in a salamander, which is nothing more than a section of enlarged iron pipe, without any chimney connection whatever. This property has enabled coke to give perfect satisfaction in certain instances where the draft available was not sufficient to burn anthracite satisfactorily. This is an important advantage and has been the means of putting coke into many homes.

It is advisable to wet down the ash pit contents prior to shaking the fire, for owing to the fine and fluffy nature of coke ash it will spread over the basement floors unless this be done. This also seems to reduce the tendency to clinkering of this fuel. Considerable prejudice is often encountered from people who have never used this fuel, the usual impression being that grates are quickly destroyed by using coke; this, however, is not the case, for unless gross carelessness is practiced, either by shaking fires down too severely or allowing ashes to accumulate underneath grates to such an extent as to prevent their being cooled by the air supply to the fire, their life will be just as long as when other fuels are used. Another common objection often heard is that as the gas has been taken out of coke, its fuel value is considerably lessened.

The author presented proximate analyses of coke taken at random to show how erroneous this view is, and added, in conclusion:

Usually there is about $1.00 difference per ton in favor of coke, and in practice it is found that one ton of coke will go as far as one ton of anthracite, with proper manipulation of fires. This, coupled with ability of building up a fire very quickly and its entire smokelessness, makes it a highly desirable fuel.

A very common mistake is often made in selecting coke prepared too large, the egg size often giving trouble from excessive clinkering, due to rapid combustion and consequent high local temperature. Sometimes the air passages are so large, particularly with thin fires, that fires are found to have been extinguished thereby. The nut or pea sizes are to be recommended for use generally in nearly every type of house-heating appliance, and in the experience of the writer have proven to be very much easier to control than bituminous coals.

Mr. Still said he had had some ex-

perience in burning coke in his own home and he had found that it is necessary to guard against too large lumps of coke, as with large lumps the fire is apt to go out and, in any case, the fire is hard to keep up.

Acting on a suggestion of Mr. Braemer it was voted to appoint a committee to see the United States Weather Bureau with a view of standardizing the bureau's weather reports, and to obtain, if possible, continuous readings of relative humidity so that the reports would be more useful to the manufacturers interested in air conditioning. There are something like 110 industries, he said, who would be benefited by such information. The committee will also try to have observations made in outlying districts, as well as in the centers of cities, as is the present practice.

Mr. Bahnson stated that in an investigation which he made he found that both the temperature and relative humidity at 10 a. m., in any city corresponded very closely to the average for the day.

A letter was presented from Professor A. C. Willard of the University of Illinois inviting the members to inspect the testing plant at that university.

For the installation of the new officers, Frank K. Chew, J. A. Donnelly and C. A. Bradbury were appointed a committee to escort the newly-elected officers to the rostrum.

The new president, Walter S. Timmis said he realized the stupendous task ahead of him but counted on the spirit of service on the part of the members. He stated that the American Gas Association had offered to place its facilities at the service of the society and pledged his services for the coming year.

James H. Davis responded for the new first vice-president, Dr. E. Vernon Hill and J. D. Cassell responded for Second Vice-President M. W. Franklin.

The other officers were then presented, including Secretary C. W. Obert, who was given an ovation. In responding Mr. Obert spoke of the pleasure he had taken in the work of the society and referred also to his work for the A. S. M. E. boiler code committee in connection with the formulation of the rules for low-pressure boilers. He had been able to use the influence of the society in modifying some of the rules first proposed for this code, which might have worked a hardship on the boiler manufacturers.

President Timmis then announced the committee appointments for the year, including the following:

Publication, C. L. Riley, chairman.

Membership, H. W. Fielding, chairman.

Code for low-pressure heating boilers, Homer Addams, chairman.

To Confer with the National District Heating Association, W. H. Driscoll, chairman.

Ventilators, J. W. H. Myrick, chairman.

Weather Bureau, W. G. R. Braemer, chairman.

Increase of Membership, W. F. McDonald, chairman.

Dehydration, Bert C. Davis, chairman.

MEMBERS OF RESEARCH BUREAU COMMITTEE.

President Timmis also announced the following names as his nominations for the Research Bureau Committee, all of his choices being approved by the meeting:

To serve three years: J. Irvine Lyle, chairman; H. M. Hart, J. D. Hoffman, William F. McDonald, Perry West.

To serve two years: Homer Addams, E. Vernon Hill, F. R. Still, A. S. Kellogg, J. R. McColl.

To serve one year: Bert C. Davis, A. T. Lewis, G. E. Bennett, S. E. Diffle, G. W. Martin.

The Entertainment.

An enjoyable programme for the ladies was carried out by a committee headed by B. K. Strader, and including Samuel L. Greason, Arthur Ritter, J. Barton Garfield and H. G. Issertell.

On Tuesday evening the ladies were taken to the Rivoli where they saw moving pictures. Wednesday they took luncheon at the new Commodore Hotel and in the evening were taken to the Hippodrome. The society's dinner and dance was held at the Hotel McAlpin Thursday evening.

The Annual Dinner.

A record-breaking attendance of 164 members and guests at the society's annual dinner was a fitting climax to a meeting that was a record-breaker in many other respects. The dinner was held at the Hotel McAlpin. The retiring president, Mr. Still, asted as toastmaster. Both Mr. Still and the new President, Mr. Timmis responded to toasts. Other speakers were C. H. Staples, of Buffalo, and Wing T. Wetmore.

Following the toasts the evening was given up to dancing.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

New Chapters of the Society.

As a result of recent activities of several of the officers of the heating engineers' society, coupled with the efforts of members at various points, new local chapters of the society have been established in Boston, Buffalo and St. Louis. Among those who have been visiting one or more of these cities in the interest of the society, with special reference to the establishment of the Research Bureau, are President F. R. Still, Past President J. I. Lyle, Vice-President Walter S. Timmis, Secretary C. W. Obert, M. W. Franklin, W. F. McDonald, E. E. McNair, J. H. Davis, W. H. Carrier and Homer Addams.

Organization has been completed in each case as follows:

Massachusetts (headquarters, Boston): President, Fred S. Boltz; secretary, Charles Morrison.

Western New York (headquarters, Buffalo). President, L. A. Harding; secretary, C. W. Farrar.

St. Louis: President, Edwin S. Hallett; secretary, L. Walter Moon.

Illinois Chapter.

At the January meeting of the Illinois Chapter a proposal was made to establish a "cadet" membership in the chapter for members of the profession who are not members of the society. A tribute was paid to Secretary A. E. Stacey by George S. Mehring who presented him, on behalf of the chapter, with a ring in appreciation of his services as secretary.

The speaker of the evening was President G. W. Hubbard who addressed the chapter on "Some Engineering Features of the United States Powder Plant at Nitro, W. Va." The chapter reported 30 applicants for membership.

F. R. Still To Visit the Orient.

Within a short time F. R. Still, vice-president of the American Blower Co., Detroit, who has just completed his term as president of the American Society of Heating and Ventilating Engineers, will start on an extended business trip to the Orient. He will visit China, Japan, Australia and India and probably will return via the Mediterranean, making a circuit of the world.

Methods of Making Coal Dust Harmless.

Coal dust can not entirely be gotten rid of in a coal mine by any practical method, but it can be so treated that it will not be a source of danger. The chief methods by which it can be efficiently treated are as follows:

1. By spreading rock dust with a blower or by hand.
2. By humidifying the ventilating current with steam jets.
3. By watering or washing down the walls, roof timbers, and floor with a hose.
4. By using tank cars that forcibly spray not only the floor but also the walls and roof.
5. By spraying with a solution of calcium chloride, and also spreading granulated calcium chloride.

The adoption of these methods is under the control of the mine management, but every miner has the right to observe whether the result makes a safe mine in which to work, and if the watering is deficient he should so report to the foreman.—GEORGE S. RICE, Chief Mining Engineer, Federal Bureau of Mines, in the *Miners' Safety and Health Almanac* for 1919.

MODERN PRACTICE IN VAPOR HEATING

VIII.—The Webster System.

EDITOR'S NOTE.—*For the purpose of this series of articles, a vapor, vacuum, vapor-vacuum, vacuum-vapor, atmospheric, modulated or therograde system of heating will be considered as any system in which the steam pressure ordinarily carried is practically at atmosphere or slightly below or in which the returns are open to the atmosphere and where no pump or other positive mechanical device is employed to pull back the returns.*

The modulation system developed by Warren Webster & Co., Camden, N. J., follows the general lines of some of the other vapor systems already described except, of course, that certain specialties of Webster design are utilized. The layout of a typical system of piping is illustrated in Fig. 1 and it will be noted that the steam is fed to the radiators at the top in the customary manner, while the returns pass out of the radiator through a trap, and return to the boiler through a check valve, the air being relieved on the way by means of the Webster modulation vent trap.

The supply to the radiator is controlled by means of the Webster modulation valve which is produced with six different styles of handles although the No. 10 handle (illustrated in Fig. 2) may be considered as the standard, owing to its greater popularity. This valve is constructed as shown in the cross-section, Fig. 3, and controls the flow of vapor into the radiator by lifting a valve cylinder with a diagonal cut past the valve seat so as to increase and diminish the orifice.

On the return end of the radiator a positive trap is used, this being preferably the "Sylphon" trap, a thermostatic trap with the expansion member formed by a sylphon bellows made of seamless tubing with twelve corrugations. A cross-section of this trap is shown in Fig. 4. Owing to its thermostatic operation it will pass cooled condensation or air but closes when hot steam strikes the bellows.

Another slightly cheaper type of trap which is sometimes used by the same organization is known as the No. 7 trap, shown in cross-section in Fig. 5. This

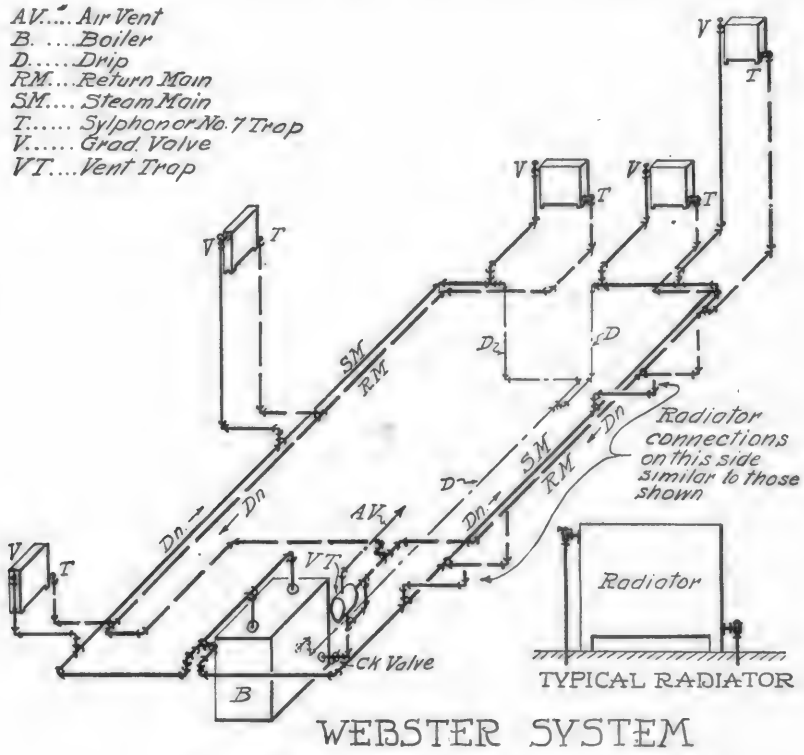


FIG. 1—TYPICAL LAYOUT OF WEBSTER SYSTEM.

second type of trap is of the multi-diaphragm type and its operation is similar to that of other disc traps already described.

Hot water radiators are used and the claim is made that this system of vapor heating can do everything which can be

FIG. 2—WEBSTER MODULATION VALVE.

done with hot water and a few things which with hot water are impossible.

The piping system is designed so as to secure the circulation of the vapor with a very small drop—usually not over 2 oz. per 100 ft. of run or its equivalent. The ends of the steam mains are dripped into a wet return, which is carried back to the boiler without passing through a check valve.

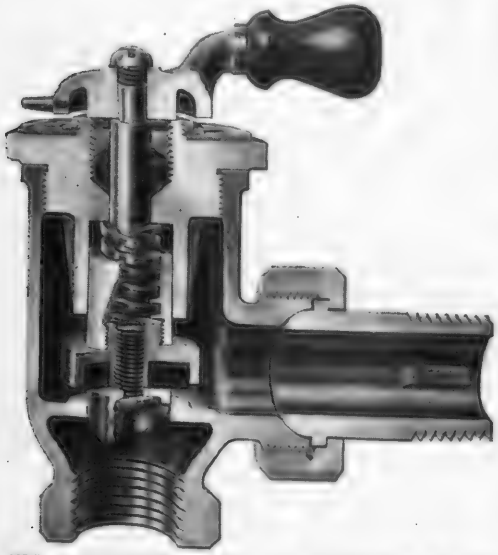


FIG. 3—CONSTRUCTION OF WEBSTER MODULATION VALVE.

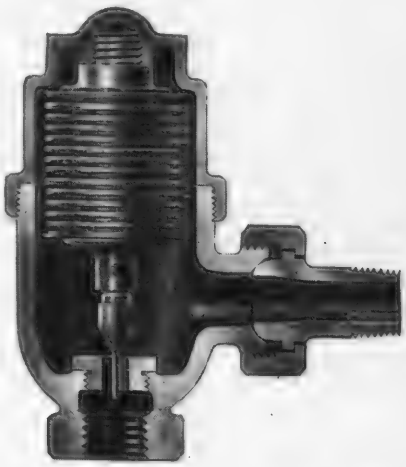


FIG. 4—"SYLPHON" TRAP USED ON RETURN END OF RADIATOR.

The radiator returns, owing to their carrying air are run back as dry returns to the point where the vent trap is located, and bypass around the trap, entering the boiler through a check valve as shown in Fig. 1. The vent trap, which is illustrated in Fig. 6, operates to relieve the system of air. The air pressure as it accumulates causes the water line in the trap to lower which

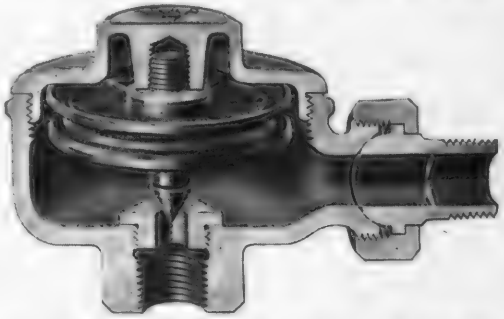


FIG. 5—MULTIPHRAGM TRAP SOMETIMES USED ON RETURN END OF RADIATOR.

in turn allows the float to fall, thus opening the valve on the air vent pipe.

The last important item of success in this system is not in any way connected with the piping but is installed directly on the boiler, being the damper regulator. As can be seen in the cross-section view, shown in Fig. 7, this device consists of a lower chamber partially filled with water. From the bottom of this chamber a small pipe is carried up and connected to the lower space below the diaphragm so that any pressure exerted on the surface of the water in the lower chamber will result in

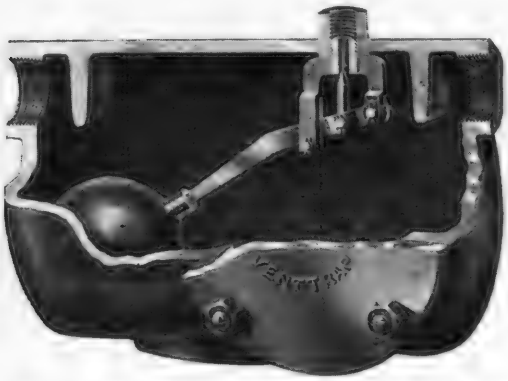


FIG. 6—VENT TRAP TO RELIEVE SYSTEM OF AIR.

driving the water out through the pipe and up into the upper chamber where it exerts

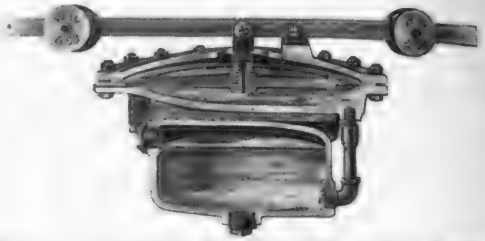


FIG. 7—DAMPER REGULATOR USED WITH WEBSTER SYSTEM.

an upward pressure on the diaphragm and thus operates the dampers. A steam pipe from the steam main is connected into the regulator just above the water level in the lower chamber and any increase in steam pressure at once begins to drive out the water and thus operates the diaphragm which controls the drafts.

THE RECONSTRUCTION ERA

Recommendations of the Federal Trade Commission for Bettering Trade Practices.

In a recent address by William B. Colver, chairman of the Federal Trade Commission, he presented the following recommendations as those having the backing of the commission:

1. Standardized accounting systems, suited to the various industries.
2. Cost and profit accounting for individual products.
3. Reasonable standardization of products and elimination of excessive costs due to unnecessary multiplication of styles and types.
4. Compilation and issue of current, basic trade information.
5. Conferences between industries and Government for the exchange of proper and useful views and information.

The Government as a Consulting Expert to Industry.

Included in the plans of the Working Conditions Service of the Department of Labor is a project to have the government serve as consulting expert to employers and employees in industrial production. This field includes sanitary and safety standards, the administration of measures necessary to prevent physical disabilities, and the relations between managers and employees known as employment problems. The Division of Industrial Hygiene and Medicine will develop standards of sanitation and medical practice in industries. The Division of Labor Administration will advise employers as to employment systems and labor management policies, and assist in putting into operation standard policies. The Division of Safety Engineering will develop standards and practices for accident prevention and advise employers as to safety methods best adapted to their plans. The director-general of the Working Conditions Service is Grant Hamilton.

What Shall Be Done With the Government's Surplus Building Material?

In connection with a plan proposed by a number of interested manufacturers for the physical reconstruction of the devastated areas in Europe, it is brought out that the Construction Division of the United States Army has here in America $30,000,000 worth of building material that has never been used. Included in this is enough lumber to build 60,000 five-room houses. There is about $7,000,000 worth of heating, plumbing, piping and other sanitary and water-supply fixtures. One

of the proposals is that all the building material and other equipment owned by the government, both here and in France, be given to France and that this be considered as a part of the cost of the war, to be included as a part of the bill against Germany.

Construction Division of the Department of Labor Organized.

A new division has been created in the Department of Labor for the purpose of interesting the nation in public works and private construction. The new service will gather and distribute information that will enable private initiative to make the transition from a war to a peace basis without serious interruption, due to lack of data on which business judgment must depend. A survey of business conditions is being made with a view of learning how capital and labor may be profitably employed during this period. The division which is carrying on this work has been organized by F. T. Miller, a publisher of construction periodicals, as a section of the Department's Information and Education Service and is called the Division of Public Works and Construction Development. It occupies the building at 16 Jackson Place, Washington, D. C.

It is expected that the facts made available will be of help to any community or investor in determining whether it is advisable to undertake public or private building at present. The field includes the cost and supply of building materials, the amount of labor available and its cost, the values of land, prevailing rents, the suuply of capital, the amount of construction held up by the war and the demand for building in all parts of the country. The finding of the bureau will be given the widest publicity.

Ben Franklin Issue of War Stamps.

The government's campaign for the sale of $2,000,000,000 of war-saving stamps during 1919 is now well launched. Attention is called to the fact that old cards that were used for the 1918 stamps will not be available for those of 1919. The limit of purchase has been set at $1,000 per individual and this limit is not affected by the amount of 1919 stamps that may have been purchased.

One feature of the campaign that is being dwelt on is that the thrift stamps may be made a large factor in the Americanization of the foreign-born, 13,000,000 of whom must be taught the language of America, and an understanding of American ideals and American citizenship, if the United States is to succeed in its great task as the "melting pot" of the world.

A New Federal Body Proposed to Supervise Industry.

A plan is being developed by M. L. Requa, head of the Oil Division of the U. S. Fuel Administration for a national Board of Trade to handle relations between industry and the government. The plan calls for a body to counsel, advise and regulate industry. Such a body would largely take the place of the present Federal Trade Commission.

Suggestion of Construction Industries for Handling Reconstruction Problems.

Two recent bulletins issued by the National Federation of Construction Industries, which was formed in Atlantic City last July and permanently organized at the same place in December, 1918, contain suggestions from the industrial world regarding such subjects as the cancellation of war contracts, restoration of construction activity and cooperation of the government.

Regarding the cancellation of war contracts the federation is prepared to support the pending bill in Congress with certain reservations. For instance, it is believed that the bill should apply to all departments, instead of merely to the War Department. It also considers the provision insufficient in several respects which states that "where no property has been transferred, delivered or accepted, payment shall not be in excess of the actual cost incurred in preparation for performance." Nothing is said in this provision about the contractor's obligations to others which he must meet. It is suggested that the word "cost" be stricken out and the words "expenses and obligations" inserted.

The federation commends the creation of the new Division of Public Works and Construction Development of the Information and Education Section, Department of Labor, whose object is to promote the restoration of building and engineering construction throughout the United States. It is expected that the new division will thoroughly investigate prices and the causes which may influence their fluctuations.

Notice is taken of the fact that the Treasury Department has issued plans for thirty-seven public buildings in different parts of the country, and the under-

standing is that Congress will authorize at this session a $10,000,000 programme of construction for the Public Health Service, while in many cities, the programme for general building is far advanced.

Endorsement is given by the federation to the appointment of Franklin T. Miller, president of the F. W. Dodge Company, as chief of the new division in the Department of Labor. Mr. Miller is described as being thoroughly acquainted with the problem of building and construction in the United States. The federation is authorized to say that any suggestion from associations or individuals in any branch of the building industry will be gladly received. Letters should be addressed to Mr. Franklin T. Miller, Division of Public Works and Construction Development, Department of Labor, 16 Jackson Place, Washington, D. C.

Reconstruction Work in France.

There is a touch of poignancy in the French point of view on the reconstruction of its devastated areas, as given by several French speakers at the December meeting of the New York Chapter of the American Institute of Architects. All of the speakers were agreed that while France will need and will appreciate materials and ideas regarding industrial housing, the offers of Americans who wish to help in the reconstruction in France will not be accepted.

The keynote of France's feeling were sounded by Pierre le Bourgeois, of the French High Commission in the United States, who said:

"The French refugees are naturally discouraged with life. The new homes must be agreeable and pleasant, to give them renewed confidence in life and to stimulate them to go on. We feel that only the French architects understand the feeling that these refugees want in their homes. It is such a very personal and local matter, that it is hard for people of another country to enter into it. We also feel that these new houses will be the best cure for Bolshevism. If people are happy in attractive homes, they are not discontented."

Another speaker stated that the "Monuments Historiques would not be restored, as this would be worse than the German shell. The reconstruction work will consist of three classes: first, repairs on a large scale; many towns are only slightly damaged. There will be, therefore, only a chance to make repairs and no change in the town plans. Second, enlarging old cities, where growth is desired, by means of carefully worked out 'Plans d'embellissements.' Third, entire new towns built outside of old destroyed towns. Certain towns will not be rebuilt on their old sites. For instance, it is proposed to build the city of Arras closer to the sea."

A Plan for One American Engineering Society.

In connection with the discussion arising over the proposition of a closer union of at least the larger engineering societies, which was brought up at the recent annual meeting of the American Society of Mechanical Engineers, the following plan for "one American Engineering Society" was proposed by Former President Jesse M. Smith:

In order that the profession may be truly solidified, I believe that there should be *one* American Engineering Society and that the U. E. S. and its four Founder Societies should be merged into *that one,* not only for business purposes but also for social purposes and for the general good of the profession, but principally for *purely professional purposes.*

Let me briefly outline a plan which has been revolving in the back of my head for several years.

1. Let the members of the four Founder Societies take membership in the American Engineering Society in such grades as they are qualified to occupy according to the present qualifications for membership in the Founder Societies. These qualifications are now substantially the same in each of the four Founder Societies.

2. Let all other engineers, who are members of other societies or are not members of *any* society, take membership in the American Engineering Society according to their ability to meet the qualifications established by this society.

There would thus be created a National Society of enormous membership, of 100,000 or possibly 200,000 members.

Such a society would be unwieldly for the transaction of its affairs, either professional or business, were such affairs not committeed to boards or committees. Many engineers regret the passing of the smaller societies where the members came into close personal touch and the papers were freely and intimately discussed. This was true of each of the Founder Societies in their earlier days—but those days have now passed.

To meet these objections, which are real, it is proposed to form the large membership of the American Engineering Society

into branches—or groups according to *Specialties in Engineering.*

Each branch should consider *only purely professional subjects* in its own specialty and its affairs should be in charge of a committee of its *own members* elected by the *members* of the branch, and should be presided over by a vice-president also *elected by the members of the branch,* and who should also be a member of the governing body of the society.

The governing body or Board of Directors of the society should consist of:

The President to be elected by the entire voting membership of the society.

One Vice-President to represent, and be elected by, the voting membership of each branch.

One Director to represent, and be elected by, the voting membership of each branch.

A Technical Secretary of each branch.

A General Secretary of the society.

A Treasurer of the society.

The Board of Directors should control the general affairs of the society and direct the policy of the society as well as the general policy of the branches, leaving to each branch the detail of the conduct of its own meetings.

All publications should be undertaken by the society. The proceedings of each branch should be published as a separate volume. One volume should be given to each member of the society free of cost, but he should have the right to subscribe for as many other volumes as he would care to pay for at cost price. All volumes should be available for sale to the public at more than cost price for the benefit of the society.

Membership fees in the American Engineering Society should be as low as possible in the junior grade and increase with the higher grades so that there would be ample funds from membership fees to meet the requirements of the society in all its activities.

So much in a broad way for the professional side of the question.

Now for the social side: The getting together of engineers in elbow touch for conference and social intercourse is quite as important as the professional contact.

The social and professional contact should not, however, interfere with each other and should be organized in a sense independently of each other. Members of the society should all be eligible to membership in the social organizations but should only become members of those social organizations upon the payment of a separate fee for the support of those organizations.

The American Engineering Society should encourage the formation of a series of engineering clubs in different cities which would be the centers of engineering activities in those cities and which would naturally be the centers of professional sections of the American Engineering Society in those cities.

When the Founder Societies and other engineering societies are merged into the American Engineering Society the local sections of these various societies would also naturally be merged and have their centers in local engineering clubs.

Local engineering societies might also be merged into such local sections and clubs.

A member of an engineering club in any city should be given the privileges of the engineering clubs in other cities.

Professional engineers will only become a real power in our country's affairs when they are consolidated for coöperation in professional work and become *a single unit* in all that relates to the profession at large.

Ventilation Commission Appointed in Massachusetts.

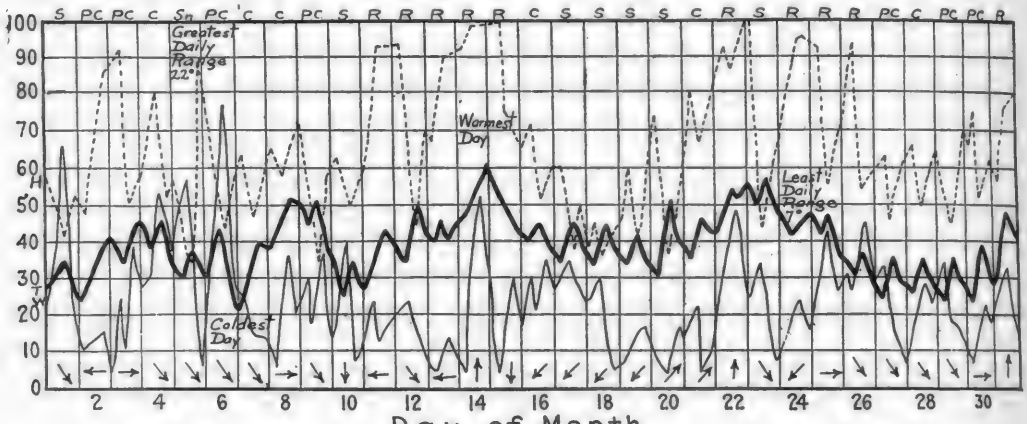
School houses and classrooms in Massachusetts are to be the subject of an exhaustive investigation regarding their air conditions, with a view of determining whether any changes should be made in the existing laws of that State. A special commission has been appointed for the purpose by the Massachusetts legislature, upon recommendation of the building inspection department of the district police. It is made up of Deputy J. J. Carey, of the building inspection department; Dr. B. L. Champion, of the State Board of Health; Edward C. Baldwin, representing the State Board of Education; Eugene Stone, of the Stone-Underhill Heating & Ventilating Co., Boston; and James Allen, Lowell, an architect who has specialized on school buildings.

Two hearings have already been held by the commission at the State House in Boston, at which the views of all interested, including open-window enthusiasts, were presented before large gatherings.

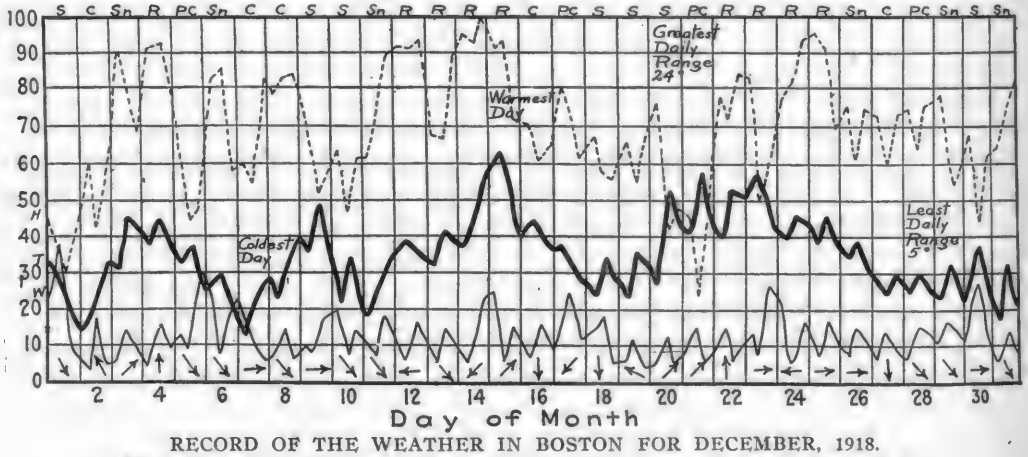
The immediate plans of the commission include a visit to the State School in Canton, two Boston schoolhouses, two Lowell schoolhouses, the new high school in Arlington and other buildings in various parts of the State.

THE WEATHER FOR DECEMBER, 1918

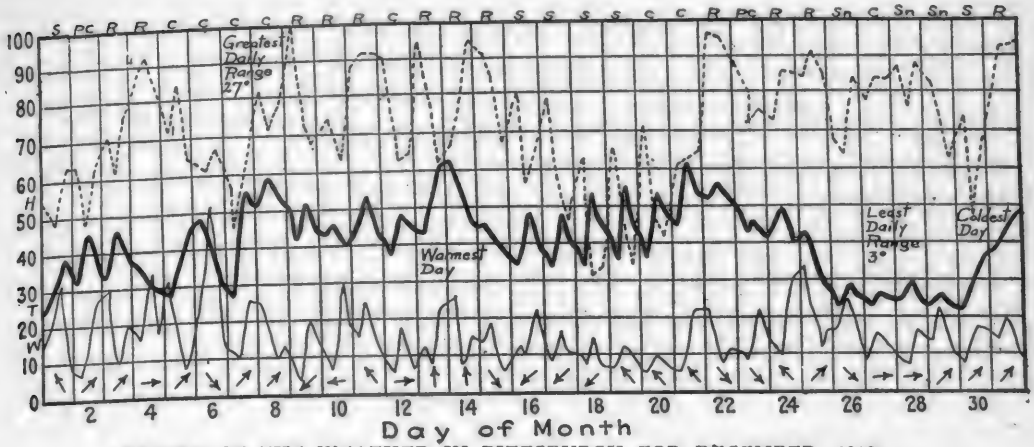
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, degrees F	61	63	62	56	74
Date of highest temperature	14	15	13	19	9
Lowest temperature, degrees F	21	13	22	14	14
Date of lowest temperature	6	7	30	26	26
Greatest daily range, degrees F	22	24	27	15	37
Date of greatest daily range	6	20	7	5	5
Least daily range, degrees F	7	5	3	3	4
Date of least daily range	24	28	27	27	13
Mean temp. for month, degrees F	39	35	41	37.7	43
Normal mean temp. for month, degrees F	34.4	31.6	34.7	29.3	35.5
Total rainfall, in.	3.70	3.21	3.5	3.24	2.69
Total snowfall, in.	0.4	8.4	1.4	8.8	0.5
Normal precipitation, this month, in.	3.45	3.41	2.73	2.07	2.23
Total wind movement, miles	13234	6992	8866	9341	10086
Average hourly wind velocity	17.8	9.4	11.9	12.6	13.6
Prevailing direction of wind	N. W.	N. W.	S. W.	W.	S.
Number of clear days	7	8	6	3	9
Number of partly cloudy days	10	5	2	7	10
Number of cloudy days	14	18	23	21	12
Number of days on which rain fell	15	15	15	15	11
Number of days on which snow fell	2	6	2	5	1
Snow on ground at end of month, in.	None	0.1	None	2.5	None



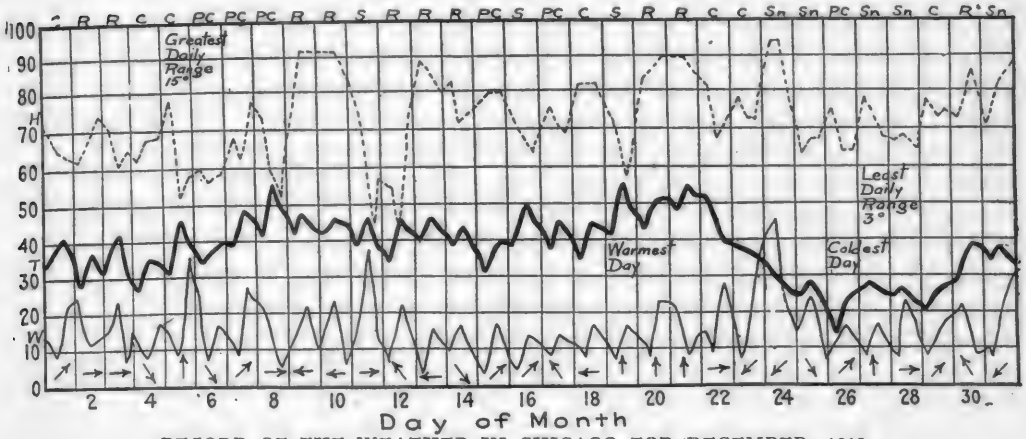
RECORD OF THE WEATHER IN NEW YORK FOR DECEMBER, 1918.
(Relative Humidity Curve Plotted from Hourly Readings.)



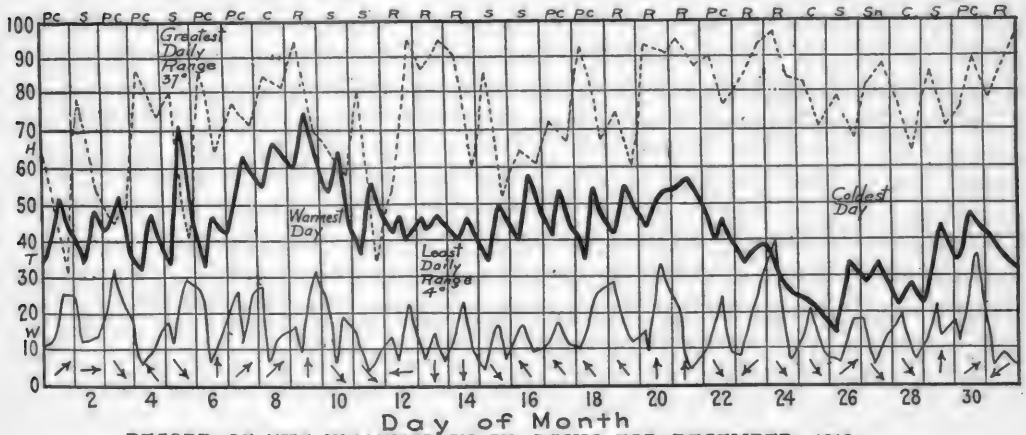
RECORD OF THE WEATHER IN BOSTON FOR DECEMBER, 1918.
(Relative Humidity Curve Plotted from readings taken at 8 a. m., 12 m. and 8 p. m.)



RECORD OF THE WEATHER IN PITTSBURGH FOR DECEMBER, 1918.
(Relative Humidity Curve Plotted from readings taken at 8 a. m., 12 m. and 8 p. m.)



RECORD OF THE WEATHER IN CHICAGO FOR DECEMBER, 1918.
(Relative Humidity Curve Plotted from readings taken at 8 a. m., 12 m. and 8 p. m.)



RECORD OF THE WEATHER IN ST. LOUIS FOR DECEMBER, 1918.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate relative humidity in percentage from readings taken at 8 A. M. and 8 P. M.
S—clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing direction of wind.

The Rise and Fall of the Muslin Window Screen.

Something of a sensation was caused a few years ago when the use of cloth windows was seriously recommended as a solution of the ventilation problem. Such window screens were used in school buildings in a number of cities and, in many cases, those using them were enthusiastic over the results obtained. Why they were never seriously considered by heating and ventilating engineers will be understood from the following indictment of the cloth window screen, written by Dr. E. Vernon Hill, chief of the Ventilation Division of the Chicago Department of Health and published in *Sirocco Service* for January, 1919:

"This scheme is positively atrocious and has no redeeming features. To quote from the doctor who advocated them, 'A cloth screen so constructed admits an abundance of fresh air; it does not obstruct the light and it keeps out dust, snow, rain and wind.'

"Practically every one of these statements is without foundation in fact. Such a screen does not admit an abundance of fresh air except when the wind is in the right direction and blowing at a velocity of something over ten miles per hour. In still weather the air change through these screens is almost negligible. There is a considerable heat loss, out of proportion to the air change, and the method is undesirable for this reason. Instead of not obstructing the light the screens obstruct the light materially. This is not so evident on a bright or sunny day but when the sky is cloudy the reduction in the amount of light in a class room is considerable.

"The worst part of the misstatement is that it keeps out the dust. It is true that the screens removes a certain portion of the air dust, namely the large particles. Unfortunately these large particles are the least harmful. They are heavy and sink in a short time to the floor. It is the fine particles that pass readily through the cloth that are harmful. Being light they do not readily settle out of the air but remain suspended for long periods of time. These fine dust particles with their attendant bacteria are inhaled by the pupils and the long train of irritative and infectious lesions of the nose, throat, and lungs is the result.

"It is rather interesting to note that the learned doctor states than 'an abundance of air enters through these cloth screens but it keeps out the wind.' An analogous situation to say the least.

"It is evident not only from a careful theoretical examination of this scheme, but it is also evident from observations made of its practical application that it is entirely worthless and should be discouraged. The cloth screen proposition; the various types of patented window ventilators and other schemes proposed by cranks and faddists that have no warrant except the blind faith of their sponsors should find no place in our school rooms."

Fuel Conservation in Canada.

An idea of the procedure followed by the Dominion Fuel Controller in Canada to save coal is shown by the forms which are used by the Ontario provincial fuel administrator. These forms are sent out to all large consumers.

While Canada is not on a fuel-rationing basis, still, according to an order-in-council issued by the Dominion Government under date of November 22, 1918, the fuel administrators may prohibit entirely or limit in any manner specified the use of anthracite coal of what is commonly known as prepared sizes in any building whatsoever within such town or city other than private residences using less than 40 tons of coal annually, and Dominion or Provincial buildings, without the owner or agent of such building obtaining a permit in writing signed by the fuel administrator.

As there was certain to be a shortage of coal in Canada, the Ontario fuel administrator issued the two forms here shown and sent them out with a statement urging the local fuel commissioners to urge upon owners and lessees of all buildings, other than residences, and using 20 tons or more coal per year, to fill out and return the forms in duplicate. It was further stated that when the forms had been filled in and returned, the proper regulations would be issued, but in the meantime it was urged that "owners of residences who have more than 40 tons of coal in stock, and the owners or lessees of buildings and governing bodies of institutes who have anthracite coal in stock and who are able to burn bituminous, to take immediate means to dispose of their anthracite supply to their friends and neighbors so that they may, at an early date and while there is still a surplus of bituminous coal, secure their new stock of bituminous coal and place themselves

in such a position that the new regulations will not apply to them."

It was also pointed out that while the Dominion and Provincial buildings were excluded from the order-in-council, the Dominion and Provincial governments have entered into a satisfactory agreement whereby bituminous coal is being substituted for anthracite for the heating of public buildings.

British Measures to Meet Fuel Problems.

Details of the heroic measures taken by the British government to meet the fuel problems resulting from the war are presented at length in a memorandum supplemental to the general report of the commission sent abroad by the United States Fuel Administration. Where the United States was able to increase its coal production, Great Britain, during the five years of the war, suffered a loss of approximately 185,000,000 tons mined, using the 1913 production figures as a basis for computation.

The steps taken to meet the situation included government control of mines, restriction of export, rationing of households, designed to conserve 8,000,000 of the 40,000,000 tons normally consumed annually for domestic purposes; and "zoning" consumers to the mines nearest them.

The rationing system has not been in operation a sufficient length of time, the commission found, to allow for an effective check on its results. Rationing was applied to the whole country only in the fall of 1918, though London was rationed in the winter of 1917. Where the French system is to ration coal upon a per capita basis, the British allowance was computed upon the number of rooms occupied.

"Building Bigger Business" Campaign To Be Renewed.

Plans are being made by the Trade Extension Committee, representing various interests in the heating and plumbing trades, to renew the campaign for "building bigger business," which had to be stopped last Fall owing to Federal restrictions. The ideas along which the committee was to continue its work in more propitious times were presented to the Central and Eastern Supply Associations and were published in THE HEATING AND VENTILATING MAGAZINE for October, 1918. Particular stress will be laid on a sales campaign between the representatives of the supply houses and their customers, the contracting fitters and plumbers. In the meantime the use of the "premise report card" is advocated as an effective means of stirring up new business.

Electric Fan as an Auxiliary in Furnace Heating.

How an electric fan can be used to increase the efficiency of a hot-air furnace is shown in the accompanying illustration, which is that of an actual installation. In this particular case, the furnace is used to heat a seven-room house and has four hot-air risers. Cold air is taken from the basement. Normally this furnace could not keep more than three risers heated at the same time in extreme weather and it seemed that no amount of changing drafts. The owner then hit on the idea of blowing cold air into the heating jacket. An 8-in. Westinghouse fan was used for this purpose, and it is stated that the owner has not had any difficulty since in forcing heated air through all of the ducts.

Another case is cited where electric fans of the office type have been used to increase the efficiency of radiators by forcing a current of air over the coils. Some advo-

ELECTRIC FAN USED TO FORCE AIR THROUGH CASING OF WARM AIR FURNACE

cates of this method favor placing the fan on the floor in order to maintain the natural direction of the air circulation. As a rule, however, better results have been obtained by forcing a downward current of air over the heated surfaces which results in distributing the warm air across the floor surface.

New Publications.

COAL SAVING IN THE HOME is the subject of a 4-page circular intended for general distribution and issued by the United States Fuel Administration. In addition to a set of general rules for operating hot-air, steam or hot-water plants or kitchen ranges, a set of specific rules are included for each method of heating. This matter is supplemented with two illustrations, contrasting poor with good practice in operating warm-air furnaces.

MINERS' SAFETY AND HEALTH ALMANAC FOR 1919, compiled by R. C. Williams, assistant surgeon of the U. S. Public Service, has been published by the Department of the Interior. It is replete with information and data, presented in a most readable form. Size 6 x 9 in. Pp. 48.

METHOD OF LEAST SQUARES APPLIED TO ESTIMATING ERRORS IN COAL ANALYSIS, by J. D. Davis and J. G. Fairfield, which is a description of a definite method for estimating the probable limits of error in analyzing samples of coal and how the method of least square should be applied, has been published as Technical Paper 171, by the Department of the Interior, Bureau of Mines. Size 6 x 9 in. Pp. 36.

TRAINING EMPLOYEES FOR BETTER PRODUCTION, being a symposium of experiences in American factory training departments, has been published as a Training Bulletin No. 4 by the Training and Dilution Service of the Department of Labor. In addition, a general plan is given for organizing training in a community, with details of a preliminary plan for installing a training system. Size 6 x 9 in. Pp. 28.

WHAT EVERY DISABLED SOLDIER AND SAILOR SHOULD KNOW is the title of Rehabilitation Leaflet No. 1, issued by the Federal Board for Vocational Education, Washington, D. C. The board, it is stated, has no less than fourteen district offices scattered throughout the country where disabled soldiers may apply for work, or, if his disability requires that he be given training, he may take up, without cost to him, a course of vocational training and the compensation provided by the War-Risk Insurance Act will be paid to him, but no allowance will be paid to his family. During his period of training, however, the same monthly allotment and allowance as that paid prior to his discharge from the army or navy will be turned over to his family or dependents. Upon the completion of his course of training he will continue to receive the compensation prescribed by the War-Risk Insurance Act as long as his disability continues.

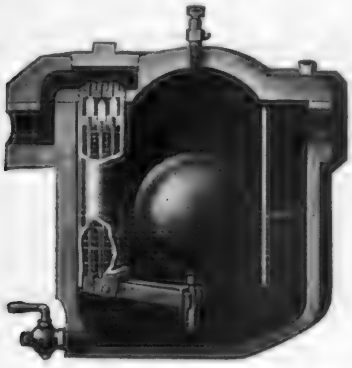
Trade Literature.

MODERN HEATING by means of Pressweld Radiation is the title of an attractive catalogue devoted to the products of the American Pressweld Radiator Corporation, Detroit, Mich. Special attention is called to the fact that these radiators are pressed and welded together to absolutely seal them against leakage. In addition, a special alloy is used which is non-corrosive and the company states that various tests and actual usage have demonstrated that there is no appreciable deterioration after years of operation. Broken views show in detail the construction of Pressweld radiators and the

TYPES OF PRESSWELD RADIATORS.

necessary data are given for the company's complete line, including single-column floor or wall radiators, three-column floor or wall radiators, and four-column radiators. The catalogue concludes with numerous testimonials from satisfied users, several of which are in the form of fac-simile letters. Size 8½x11 in. Pp. 24.

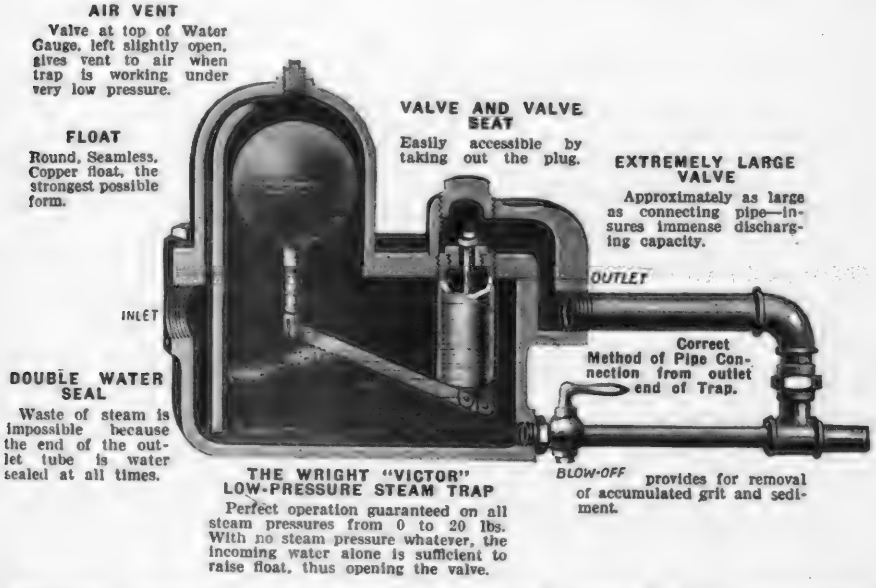
STEAM TRAPS, AIR TRAPS AND STRAINERS, featuring the Wright line of steam traps manufactured by the Wright-Austin Co.,



WRIGHT "EMERGENCY" STEAM TRAP FOR HIGH-PRESSURE WORK.

"three-valve" principle, for use with pressures up to 200 lbs. In explaining the "three-valve" principle, it is stated that by opening the valves in one-two-three order, the trap automatically adjusts itself to the amount of condensation it has to handle, thus reducing the wire-drawing to a minimum. The operation of the trap is explained in detail and illustrated by broken views of the interior. This is followed by illustrated directions for installing and operating this trap. An equally extended description is given of the Wright "Victor" low-pressure steam trap, designed to give a continuous discharge for pressures from 0 to 20 lbs. The vital feature of this trap is its continuous discharge, due to the fact that incoming condensation alone is sufficient to lift the valve. The remainder of the catalogue is given over to the Wright air trap and the Wright strainer. Size 3¼ x 6½ in. Pp. 32.

BEACH-RUSS AUTOMATIC PUMPS WITH RECEIVERS and electric house pumps are featured in Bulletin No. 10, published by the Beach-Russ Co., 220 Broadway, New York. A description is also given of Beach-Russ return line and air line vacuum pumps for vacuum heating systems, Beach-Russ


AIR VENT
Valve at top of Water Gauge, left slightly open, gives vent to air when trap is working under very low pressure.
FLOAT
Round, Seamless, Copper float, the strongest possible form.
VALVE AND VALVE SEAT
Easily accessible by taking out the plug.
EXTREMELY LARGE VALVE
Approximately as large as connecting pipe—insures immense discharging capacity.
OUTLET
INLET
Correct Method of Pipe Connection from outlet end of Trap.
DOUBLE WATER SEAL
Waste of steam is impossible because the end of the outlet tube is water sealed at all times.
THE WRIGHT "VICTOR" LOW-PRESSURE STEAM TRAP
Perfect operation guaranteed on all steam pressures from 0 to 20 lbs. With no steam pressure whatever, the incoming water alone is sufficient to raise float, thus opening the valve.
BLOW-OFF provides for removal of accumulated grit and sediment.

WRIGHT "VICTOR" CONTINUOUS-FLOW STEAM TRAP FOR LOW-PRESSURE WORK

Detroit Mich., are the subject of a handy catalogue, compiled apparently with special reference to the needs of the busy engineer. First place is given in the catalogue to the Wright "Emergency" high-pressure steam trap, with its unique positive pressure blowers and rotary air compressors and portable heaters. The Beach-Russ automatic condensation pump and receiver is designed to remove the condensation from steam heating systems, dry kilns, etc., and to automatically return

the water to low-pressure boilers. The pump has its suction connected to the receiver direct into which the condensation from the heating system flows by gravity; the discharge is connected with the boiler. It is made in two types, one designed for boiler pressures ranging from 5 to 15 lbs. and the other for 15 to 30 lbs. boiler pressure. Four sizes are made of each type, with capacities ranging, in each case, from 16,000 to 100,000 sq. ft. of radiation.

RIC-WIL PAINT, designed as a preservative paint for heated surfaces, as well as for all metal surfaces underground or exposed to the weather, dampness, salt air or corrosive gases, is featured in a recent circular issued by the manufacturers, the Ric-Wil Co., Cleveland, O. This paint is described as a pure bitumen, free from any foreign substance, and absolutely unaffected by water, acid or alkali. Nor is it affected by any vegetable matter. All volatile matter has been eliminated in the process of manufacture, making it impervious to heat and preventing it from crumbling or sloughing off. The basic material used in Ric-Wil paint, it is added, has been in the field for 20 years as a preservative coating for a wide range of uses. It is shipped in quantities ranging from 1 to 50 gal. One gallon, it is stated, will cover from 200 to 300 sq. ft. of surface

AUTOVENT MOTOR-DRIVEN PROPELLER FANS AND LOUVRES AND UNIBLADE MOTOR-DRIVEN BLOWERS are products of the Batterman-Truitt Co., Chicago, which are brought to the attention of the trade in new bulletins issued by this company (Nos. 46 and 47, respectively). In each case the units are designed for alternating and direct current. The Autovent fans are described as entirely different from other types of propeller fan and emphasis is laid on their mechanical construction. The fan motors are ventilated through a mechanical process of radial heat connection created by the operation of the fan wheel, together with the motor, in which the motor temperature is carried away with the general exhaust of the fan wheel. They are furnished in a wide variety of sizes, the bulletin containing full price lists and performance tables. Auto-vent louvres are designed to prevent back draft and to provide weather protection to fan openings when the fan is not running. They consist of a number of semi-circular vanes connected together in series. Galvanized iron is the material used in their construction. They are furnished in eight sizes, ranging from 16 in. to 48 in. in diameter. The Uniblade blowers are also described as a strict departure from other types of fan wheels, designed for quiet operation at high speeds and not to rack under strain or pressure. Special attention is called to their rigidity of construction in which the spokes of the wheels, of channel iron, form a spider and are attached direct to the retaining rings of the wheel, thereby reinforcing the entire frame. These blowers are also made in many different sizes, the bulletin containing data for each size.

CATALOGUE H (1918) OF THE DETROIT VALVE & FITTINGS AND DETROIT BRASS WORKS is the title of a handy reference volume devoted to malleable iron fittings, standard and special brass goods for steam, water and gas, Durham fittings and specialties, and special castings made of brass, malleable iron and grey iron, which are the products of these combined companies. This catalogue will be found especially useful in connection with the renewed activities in fields using this class of goods. Size 4 x 7 in. Pp. 245.

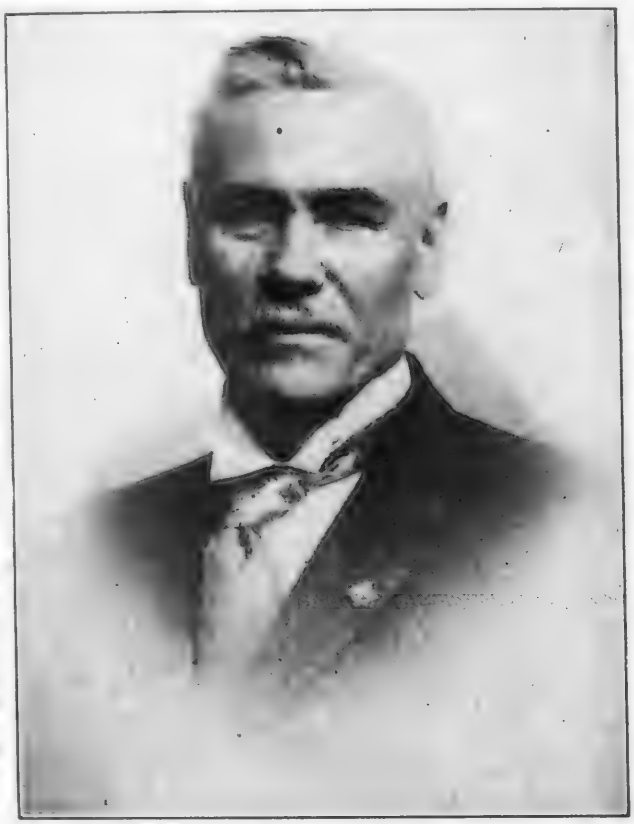
ECONOMY MANUAL, devoted to the economic application of automatic and continuous operation of electric-driven pumping machinery for use in connection with heating, ventilating and building service, and containing several pages of handy data, has been issued by the Economy Pumping Machinery Co., Chicago, Ill. Descriptions are presented of the Automatic condensation pump and receiver, Economy automatic underground pump and receiver, Economy automatic combination vacuum pump and condensation pump and receiver, together with several types of Economy belt or motor-driven vacuum and boiler-feed pumps. Typical installations are also shown of most of these devices. Size 3½x6 in. Pp. 36.

Butler & Hayes, Inc., 220 Devonshire St, Boston, Mass., is the title of a new firm of mechanical and chemical consultants and experimental engineers. The firm is composed of James A. Butler and F. Albert Hayes. Mr. Butler has been engaged as an experimental engineer in the development of printing, textile and other types of productive machinery. Mr. Hayes's experience has been in applied chemistry with leather, textile and metallurgical concerns. Both men received their technical training at Harvard University and have recently been associated with the Ordnance Department in the Boston district office.

Death of Professor R. C. Carpenter.

A pioneer and leader in the heating and ventilating profession passed on when Professor Rolla C. Carpenter, until recently professor of experimental engineering at Cornell University, died at his home in Ithaca, January 19. He was in his 67th year.

To heating and ventilating engineers Professor Carpenter's name and fame were household words. There is scarcely a man in the profession who has not at one time or another had occasion to study or consult his work, "The Heating and Ventilating of Buildings," the first edition of which was for a long time a standard textbook on the art. The book has been republished from time to time and enlarged. It is now in its third edition.



PROFESSOR ROLLA C. CARPENTER.

Professor Carpenter was an enthusiast on all subjects connected with heating and ventilation and had done much in a practical way to further their development. Personally he was a man of strong magnetism and this, coupled with a gracious and genial personality, won for him a host of friends and admirers. He was one of the charter members of The American Society of Heating and Ventilating Engineers and during the earlier years of the society's career was always present at its annual meetings and contributed freely of his knowledge in the presentation of papers and discussions. He was made president of the society in 1896.

Professor Carpenter's activities were not confined, however, to the heating and ventilating field. He had charge of many large engineering projects. He supervised the installation of the high pressure fire protection system in Baltimore in 1911 and installed the high-pressure pumping system in New York in 1912. He was one of the judges of machinery and transportation at the Chicago Exposition in 1893, the Pan-American Exposition in 1903 and the Jamestown Exposition in 1907. During the early days of the Panama Canal Professor Carpenter served as a member of the commission that was sent to the Isthmus to investigate the causes and devise remedies for the slides that were causing such serious interruption to traffic.

Professor Carpenter was one of the original stockholders in the Heating and Ventilating Magazine Company and was always numbered among its warmest friends. At the time of his death he was preparing for THE HEATING AND VENTILATING MAGAZINE an appreciation of his friend and co-worker in the heating field, the late Professor Kent, who died but a month or two ago.

He is survived by a brother, Justice W. L. Carpenter of the Michigan Supreme Court, and by a widow and three children.

Approximately 4,000,000 soldiers and sailors are now insured with the United States government for a grand total of almost $37,000,000,000. The Treasury Department is urging the men not to sacrifice this insurance which is issued, as is well known, at an unusually low rate.

MEASUREMENT OF AIR FLOW

The quantity and velocity of air discharged by a fan or flowing through a pipe may be determined by an anemometer, and orifice, a short length of pipe, a converging nozzle, or a Pitot tube.

The anemometer is used in many cases where extreme accuracy is not required or where the velocity of the air is low, and is especially adaptable to measuring air entering a room through a register or duct. The reading should be taken in the manner described on Standard Data Sheet No. 10-B. An anemometer should be frequently calibrated, as hot air will quickly dry up the bearings, and the readings will be affected as much as 10%. This instrument may also vary at high velocities.

Air may be measured by discharging into a large air-tight chamber, which can be easily provided for permanent testing work, from which the air escapes through cylindrical or conical orifices. The pressure in the chamber is recorded by a pressure gauge and the quantity of air delivered can be computed, using the coeffcient of orifice given in the table below. This method gives static pressure and not total pressure.

COEFFICIENTS OF DISCHARGE.

Angles of Convergence	Coefficient of Discharge	Angles of Convergence	Coefficient of Discharge.
0° 0′	0.825	13° 24′	0.946
1 36	0.866	14 28	0.941
3 10	0.895	16 36	0.938
4 10	0.912	19 28	0.924
5 26	0.924	21 0	0.918
7 52	0.929	23 0	0.913
8 58	0.934	29 58	0.896
10 20	0.938	40 20	0.869
12 4	0.942	48 50	0.847

In all cases, in using the above table, pressures should be taken in the chamber from which the air is discharged.

The fan may also discharge into an air-tight chamber, the air escaping through a short length of pipe, and the static pressure be accurately measured. A coefficient of 0.825 should be applied to the area of the short pipe to determine the effective area and the velocity of the air.

(Continued on Sheet No. 9-B)

MEASUREMENT OF AIR FLOW (Continued)

In commercial work, where a test is wanted before the fan is installed, a converging nozzle may be attached directly to the fan outlet, and the velocity pressure of air measured by a Pitot tube. A proper coefficient of contraction, as shown by the table below, should be used, due to the convergence of the nozzle.

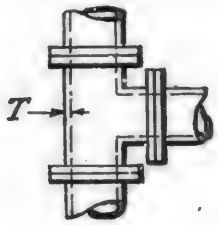
COEFFICIENTS OF CONTRACTION.

Angles of Convergence	Coefficient of Contraction	Angles of Convergence	Coeffcient of Contraction
7° 52′	0.998	23° 0′	0.937
8 58	0.992	29 58	0.919
10 20	0.987	40 20	0.887
12 4	0.986	48 50	0.861

A Pitot tube is one of the most common instruments used to determine velocity and quantity of air flowing through a pipe. This has two tubes, one inside the other. The outer tube has several small openings in the short bent portion which records static pressure. The inner bent tube has an opening in the end which records total pressure. By properly connecting the two tubes, the difference, or velocity pressure, may be read directly. In testing a fan the Pitot tube should be placed 10 to 20 diameters from the fan outlet, and the air pipe should be the same diameter as the fan outlet. Velocity pressure in the center of the duct will be higher than the average, and the reading at the center of a round pipe should be multiplied by a coefficient of 0.80 to get true average velocity pressure. For more accurate work in round pipes and for square or rectangular pipes, a traverse of the pipe should be taken and an average of all the readings used. When the pipe is square or rectangular, it may be divided into a number of small squares or rectangles, a reading taken in the center of each, and the average result will be the true velocity pressure. If the pipe is round, it should be divided into a number of concentric rings of equal areas, and four readings taken in each area, horizontally and vertically across the pipe.

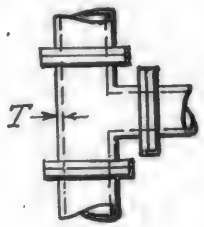
SHELL THICKNESS OF FLANGED FITTINGS

Standard Weight
125 Lbs. Working Pressure.



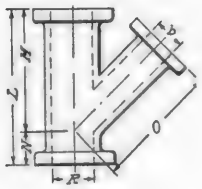
Nominal size of Fitting, Inches.	Thickness of Shell T, Inches.
2	7/16
2½	7/16
3	½
3½	½
4	½
4½	½
5	½
6	9/16
7	5/8
8	11/16
9	¾
10	13/16
12	7/8
14	15/16
15	15/16
16	15/16
18	1
20	1 1/16

Extra Heavy
250 Lbs. Working Pressure

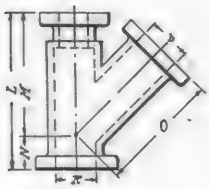


Nominal size of Fitting, Inches.	Thickness of Shell T, Inches.
2	5/8
2½	5/8
3	5/8
3½	5/8
4	5/8
4½	11/16
5	¾
6	13/16
7	7/8
8	15/16
9	1
10	1 1/16
12	1 1/8
14	1 3/16
15	1 ¼
16	1 5/16
18	1 7/16
20	1 ½

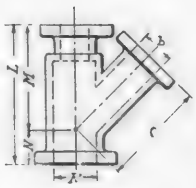
1915 STANDARD EXTRA HEAVY REDUCING LATERALS, FLANGED.



Reducing Lateral.



Reducing-on-Run Lateral.



Reducing-on-Run-and Branch Lateral.

250 LBS. WORKING PRESSURE

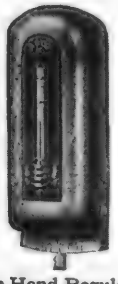
Size, In. Diam. Run	Branch	Dimensions, In. L	M	N	O	Flanges Diam. In.	Thickness In.
1	—	—	—	—	—	4½	11/16
1¼	1¼ and less	9½	7¼	2¼	7¼	5	¾
1½	1½ " "	11	8½	2½	8½	6	13/16
2	2 " "	11½	9	2½	9	6½	⅞
2½	2½ " "	13	10½	2½	10½	7½	1
3	3 " "	14	11	3	11	8¼	1 ⅛
3½	3½ " "	15½	12½	3	12½	9	1 3/16
4	4 " "	16½	13½	3	13½	10	1 ¼
4½	4½ " "	18	14½	3½	14½	10½	1 5/16
5	5 " "	18½	15	3½	15	11	1 ⅜
6	6 " "	21½	17½	4	17½	12½	1 7/16
7	7 " "	23½	19	4½	19	14	1 ½
8	8 " "	25½	20½	5	20½	15	1 ⅝
9	9 " "	27½	22½	5	22½	16¼	1 ¾
10	10 " "	29½	24	5½	24	17½	1 ⅞
12	12 " "	33½	27½	6	27½	20½	2
14	14 " "	37½	31	6½	31	23	2 ⅛
15	15 " "	39½	33	6½	33	24½	2 3/16
16	16 " "	42	34½	7½	34½	25½	2 ¼
18	9 " "	34	31	3	32½	28	2 ⅜
18	16 to 10 inc.	45½	37½	8	37½	28	2 ⅜
20	10 and less	37	34	3	36	30½	2 ½
20	18 to 12 inc.	49	40½	8½	40½	30½	2 ½
22	10 and less	40	37	3	39	33	2 ⅝
22	20 to 12 inc.	53	43½	9½	43½	33	2 ⅝
24	12 and less	44	41	3	43	36	2 ¾
24	22 to 14 inc.	57½	47½	10	47½	36	2 ¾

FUEL SAVING Assured by ARCO Temperature Regulators

In the selling of Arco Temperature Regulators the Heating Trade has the benefit of widespread publicity and all the arguments of the Fuel Conservation Bureau. These regulators will enable the householder to keep the temperature at 68° with the minimum of attention and the smallest fuel consumption. Easily installed on any heating systems.

The 8-Day Automatic Model

8-Day Model Arco Temperature Regulator can be set to close the drafts at any desired time in the evening and open them again at any desired time in the morning without attention other than to wind the clock once a week and the motor at less frequent intervals —or can be operated as a plain Thermostat adjustable for temperatures from 55 to 85 degrees.



The Hand Regulated Model

1-Day Model Arco Temperature Regulator has a time release which can be set to open the drafts at any desired time in the morning —otherwise adjustable for temperatures from 55 to 85 degrees.

Plain Model Arco Temperature Regulator. No clock—hand adjustable—will keep temperature uniform at any desired degree, from 55 to 85.

See demonstration at nearest local Branch or Sales Office and send for instructive booklets

AMERICAN RADIATOR COMPANY

Branches and Sales Offices in most large cities

TRADE AND MISCELLANEOUS NOTES

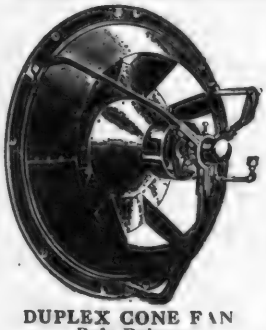
Miscellaneous Notes.

Engineering Index of periodical literature, published for 25 years by the *Engineering Magazine* and its successor, *Industrial Management*, has been acquired by The American Society of Mechanical Engineers and will be compiled and published hereafter by this society. The first issue of the Index, under its new management appears in the Society's *Journal* for January. The society will issue the Index as a part of its *Journal*, as a separate monthly publication for libraries or individuals, and as an annual volume in which all the items for the year will be collected. Nearly 1100 periodicals from all parts of the world, including THE HEATING AND VENTILATING MAGAZINE, will be indexed. Articles on mechanical engineering will be listed under 31 sub-heads.

Osborn Monnett, who has been serving as assistant advisory engineer for the Bureau of Conservation, U. S. Fuel Administration, in Washington, has returned to Chicago where he has opened an office as consulting engineer. Mr. Monnett was formerly consulting combustion engineer for the American Radiator Company and has contributed many articles on smokeless combustion, several of which have appeared in these columns.

National Foreign Trade Council will hold its sixth National Foreign Trade Convention in Chicago, April 24-26, 1919. Headquarters will be at the Congress Hotel. The convention will deal especially with foreign trade as a factor in stabilizing American industry.

Chicago, Ill.—In the first case brought by the Chicago Health Department to test its power to compel landlords to furnish sufficient heat for their tenants, the health



DUPLEX CONE FAN
Belt Driven

HOWARD & MORSE
45 FULTON ST., N. Y.
Ventilating Engineers and Contractors
MANUFACTURERS OF
BLACKMAN and DUPLEX CONE FANS
which are installed by us complete with **Motors, Duct Work** and **Wiring**.

Aligning, Rigging and **Hoisting** done, with labor thoroughly qualified from long experience.

We make a specialty of **Kitchen Exhaust** work. Prominent buildings, hospitals, theatres, and private residences are among our many and recent installations

The **Duplex Cone** Fans are semi-conoidal fans, made especially to operate against pressure in duct systems.

The **Blackman** Fans are used for fresh air delivery and in duct systems, when no great pressure is involved.

You can have the advantage of our experience.

SEND FOR CATALOGUE

BLACKMAN FAN
Direct Connected to Motor

department won a decisive victory and a fine of $100 was imposed on the offending landlord. The testimony showed that the apartments in the building in question were kept for periods at a temperature ranging from 48° to 55°. Two sick children were found in one of the apartments and a sign placed on the building by the health department had been torn down.

Chicago, Ill. In a compilation of the value of Chicago's manufacturers for 1918, published in the *Chicago Tribune*, the value of heating apparatus is give as $17,633,700, as compared with $19,593,000 in 1917.

J. A. Sullivan, Buffalo, N. Y., manufacturer's agent, has moved his office to 582 Ellicott Square. Mr. Sullivan has been connected with heating enterprises for the past 20 years and for several years has been representing manufacturers in New York State, western Pennsylvania and Ohio.

Perry West, engineer for the Newark (N. J.) Board of Education, addressed the Men's Club of the Roseville Presbyterian Church recently on the subject of "Heating and Ventilation." His talk was followed by a round-table discussion which showed the keen interest of his audience in the subject.

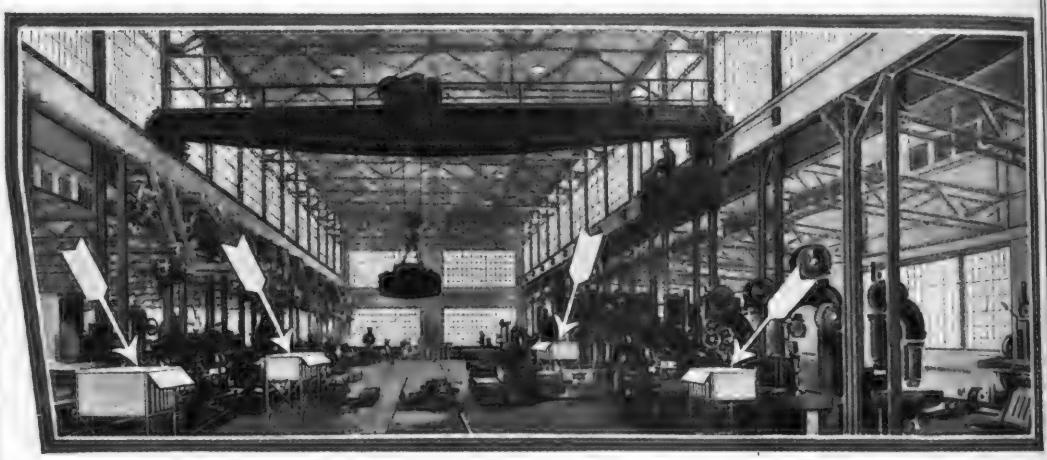
Chicago, Ill.—City Smoke Inspector Reid reports numerous violations of the city

ILGAIR UNIT HEATERS

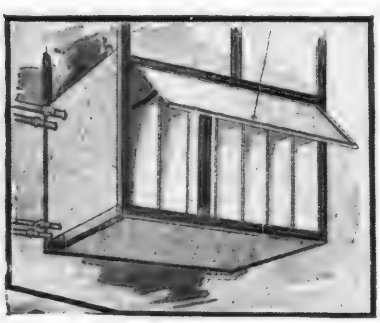
—heat open spaces with great economy

Easily installed—speed up heating—provide flexible control—prevent heat loss.
First cost and power requirements surprisingly low.

Now used in many of America's leading industrial plants.



Floor type installed in modern manufacturing plant



Ceiling Suspension Type

ILGAIR UNIT HEATERS
effectively used to "bolster up" poor systems.

Supply additional heat for "local cold spots."

HIGH EFFICIENCY TRADE ILG MARK VENTILATING MACHINERY

Write for proposition

ILG ELECTRIC VENTILATING CO.
158 Whiting St., Chicago, Ill.
Branches in all large cities

DETROIT PACKLESS RADIATOR VALVES

The Correct Radiator Valve for Vapor Heating

The Detroit Packless Vacu Valve is a Graduated Valve for Vapor and Vacuum Systems of Heating. The dial plate is provided with a series of holes and a movable pin. This pin acts as a stop for the handle pointer and is inserted in the hole in the dial nearest the point at which the valve, when opened, admits only sufficient vapor or steam to fully supply the radiator.

DETROIT PACKLESS
Vacu Valve showing Dial Plate and Lever Handle

Booklet VP-1 Gladly Sent Upon Request

DETROIT LUBRICATOR COMPANY
DETROIT, U. S. A.
CANADIAN DETROIT LUBRICATOR COMPANY, LTD. WALKERVILLE, ONTARIO.

LARGEST MANUFACTURERS OF RADIATOR VALVES IN THE WORLD

anti-smoke ordinance, especially among concerns in the "Loop" district and he has already filed a number of suits in a campaign to compel observance of the ordinance. "There are about 75% of the power plants in the downtown district," stated Mr. Reid, "which never have used any other than Illinois coal. They are not concerned about the shortage of Pocohotas coal. There is no excuse for these plants making excessive smoke. Many heating plants in large apartment buildings and the like have been equipped to use Pochontas coal and many of these need to have their equipment changed to use Illinois coal. . . ." Engineers of the department have advised plant owners how to change their equipment so as not to create excessive smoke with Illinois coal.

Cleveland, O.—The annual banquet of the Heating and Piping Contractors' Association of Cleveland, held at the new Cleveland Hotel, was the occasion of the presentation of a loving cup to the retiring president, Edward Maurer, by his fellow members. A silent toast was drunk to the memory of Fred H. Winslow, a former member of the association, who died recently. Previous to the banquet new officers were elected as follows: President, Charles H. Mallott; vice-president, W. B. Van Sickle; secretary, M. L. Crowell; treasurer, William Warren; delegate to Building Trade Employers' Association, John Becker, Executive committee: A. E. Seidel, H. Henrichsen, Charles Mutton, M. L. Crowell, William Clark, Edward Maurer and M. Jones.

Central Suply Association will hold its regular winter meeting in Chicago, February 19, at the Congress Hotel.

William G. R. Braemer, Philadelphia, Pa., has resigned as president of the Braemer Air Conditioning Corporation to open a consulting engineering office in the Stephen Girard Building, Piladelphia. He will specialize in air conditioning and drying. He will also act as consulting engineer for the company. Mr. Braemer's experience covers a period of 26 years in this line of work. During this time he has designed air conditioning and drying plants of all kinds and is the inventor of many devices that have become standard practice in this field.

Dr. M. W. Franklin has resigned as con-

PIPE BENDING

MARINE EQUIPMENT AND REPAIR WORK
HEATING AND VENTILATING

THE OHIO HEATING AND PIPE BENDING CO.
Main Office and Factory, 1061-63 West 11th Street, Cleveland, Ohio
SOLE AGENTS FOR
F. J. Nice Oil and Combination Oil and Gas Burners

RIC-WIL METHOD

MAKES GOOD
Heating Systems Better

The Ric-wiL METHOD of insulating underground steam and hot water pipes is a complete system which will save from 80% to 90% of the loss from the pipes if bare. The materials consist of a special tile conduit—vitrified and salt glazed—lined with a mineral insulation; a tile Base Drain to support the conduit and carry away the ground water, roller bearings for carrying the pipes and loose insulation for packing around them.

Write for our 40-page catalogue which explains these materials more fully

THE Ric-wiL COMPANY, CLEVELAND

sulting engineer for the E. F. Houghton & Co., Philadelphia, and will take up engineering work in the automobile industry. He was tendered a testimonial dinner in New York by the Houghton company in recognition of his services.

Central Station Heating Notes.

Decatur, Ill.—Hearings on the proposed permanent meter rate for central station heating in Decatur have been postponed by the State public utilities commission until July 12, 1919. No action will be taken, therefore, before that date. The present rate in Decatur is a temporary rate put into effect by the commission. This rate has been the cause of considerable protest by the users of steam heat in that city. The consumers are planning to obtain an injunction in the higher courts which, if granted, would throw the city back on the old flat rates and the property owners could then sue for the alleged overcharges.

Mattoon, Ill.—In the hearing in opposition to the proposed increase of heating rates for Mattoon and Paris, one of the principal points of contention was on the proposition of rendering service for twelve months instead of eight months of the year. It was stated that the consumers were not objecting to the proposed increase but wanted the company to furnish heat during the entire twelve months as, it was stated, it would be very expensive to install gas heaters to heat water for washing, bathing, etc., during the summer months. The company went on record as being willing to furnish gas heaters free to its consumers, but stated that to operate the plant during the four summer months would entail a loss of from $10,000 to $15,000 a year to the company. The matter was taken under advisement.

Pekin, Ill.—The State public utilities commission has authorized the Central Illinois Light Company to make effective a monthly steam heating rate of $1.50 per 1,000 lbs. of condensation for the first 4,000 lbs., with correspondingly lower rates to larger consumers. At the end of the present season, the new rate schedule will become void. In case the commission decides to reduce the rates before the expiration of the season, the company must refund the difference between the increased rates and the old rates, with 6% interest. The complete schedule now effective is as follows:

JOHNS-MANVILLE RADIATOR TRAP

Just a ball—that's all

OFTEN it's the smallest fitting that kicks up the most trouble. Either it's hard to connect up, or the adjustment is delicate. Or some little part keeps wearing out. And, on jobs where the margin is small, these little troubles play hob with profits.

So it will pay you to get acquainted with the Johns-Manville Radiator Trap—because it's the simplest on the market. Just three parts—body, ball and connecting union; only one moving part—the hollow ball. It regulates itself, no nice adjustments necessary, no chance of tampering. You'll find this trap a money-saver all along the line.

Supplied for straight or angle connections—right, left or bottom outlet. Pamphlet and prices on application.

JOHNS-MANVILLE SERVICE COVERS THE CONTINENT

H. W. JOHNS-MANVILLE CO.
NEW YORK CITY
10 Factories—Branches in 63 Large Cities

$1.50 per month for the first 4,000 lbs. of condensation.
65c per month for the next 100,000 lbs.
65c per month for the next 200,000 lbs.
55c per month for all over 304,000 lbs.
Minimum bill, $20.00 per customer per heating season (September 15 to May 15 and longer if weather conditions make it necessary).

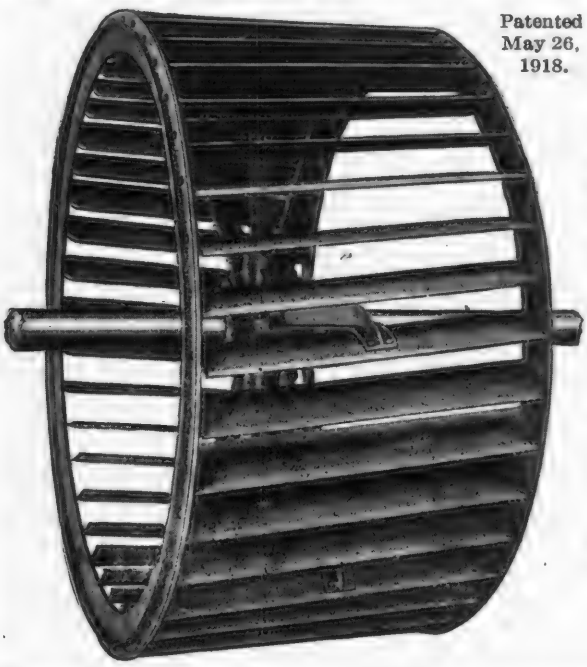
Belvidere, Ill.—At a meeting of interested parties to discuss the condition and cost of reconstruction of the central heating system in Belvidere, it was estimated by the company's engineers that the reconstruction cost would be over $75,000. Following the conference the patrons requested that the public utilities commission order the heating service continued for the 1919-1920 season without rebuilding.

Springfield, Ill.—In a hearing before the state public utilities commission on the service given by the local central heating company those who complained of the present rates brought up the point that the city of Springfield, at the present time, is buying coal at a mine on the outskirts of the city, at the rate of $1.95 per ton, f.o.b. and the opinion was expressed that the utilities company should be able to procure it at an equally reasonable rate. Commissioner of Public Works Willis J. Spaulding testified that there is every indication that the price of coal would go down still further to $1.50 per ton.

Peoria, Ill.—There is to be no increase in the rates charged in Peoria by the Central Illinois Light Company for steam heating service before July 10 according to a ruling of the Illinois State Public Utilities Commission. The company filed a petition last August for permission to raise its steam heating rates. The minimum charge for the service was to be changed from the present figure of $4.00 per month to $40.00 per season. In September the case was suspended by the commission to January 10. The new ruling, which is practically a postponement of the matter, was made, it was stated, to allow time for the completion of the hearings by the commission.

Lansing, Mich.—According to a notice received, the property of the Michigan Power Company, which has been in the hands of a receiver, was to be sold by order of the Federal Court on January 18.

A Uniform Unrestricted Flow of Air



Patented May 26, 1918.

across the entire width of the wheel means

Highest Efficiency

We do it by setting the vanes at an angle to the shaft (patented feature). Rigid and reinforced construction assures DURABILITY.

These features, coupled with "GARDEN CITY" SERVICE, should remind you of

Cycloidal Multivane

when you are interested in fans.

Catalogue containing complete data sent on request

Garden City Fan Co.

Est. 1879
CHICAGO, ILL.
Eastern Representatives:
L. J. WING MFG. CO., New York City

"Sirocco"
TRADE MARK

Speeds Up Production

In these days of rush work, with everything strained to the limit, fresh pure air for the factory is of vital importance.

The Sirocco System of Heating and Ventilating is used by many of America's best known and most successful manufacturers.

The view above shows an installation in a factory noted for its production and efficiency methods.

In the "dog days" of summer the Sirocco System is invaluable in keeping the factory workers fresh and fit by supplying the proper amount of fresh, pure air to every nook and corner.

Let us tell you more about Sirocco for your factory—Ask for Bulletin No. 270.

American Blower Company

DETROIT, MICHIGAN

BRANCHES IN ALL PRINCIPAL CITIES

Manufacturers' Notes.

American Radiator Company, Chicago, Ill., in a notice dated December 31, 1918, announced reductions of approximately 25% in the prices of American radiators, Ideal boilers and Ideal hot-water supply boilers. The announcement also stated that the company has resumed the manufacture of many patterns of radiators and some boilers which were discontinued during the war. Until further notice, the company will protect all orders against any decline in its prices. No reduction is contemplated by the company at present in the prevailing scale of wages.

Bramer Air Conditioning Corporation Philadelphia, Pa., announces the election, as its president, of John F. Hale. Mr. Hale succeeds William G. R. Braemer, who has retired from the company to conduct a business as consulting air conditioning and industrial engineer, with offices in the Stephen Girard Building, Philadelphia. Other changes in the Braemer Air Conditioning Corporation are the election of H. A. Terrell as secretary and treasurer and of E. Nesdahl as chief engineer.

Babcock-Becker Co., Cleveland, O., which took over the business of the Consolidated Engineering Company, of Chicago, some time ago has appointed Charles Lawrence manager of the New York branch of the Consolidated Engineering Company. Mr. Lawrence was formerly manager of the fan department of the Consolidated Engineering Company's New York office.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., announces the completion and formal opening of the "Essington Club," established for the comfort and convenience of its employees at the Essington Works, South Philadelphia, Pa.

Braemer

Air Conditioning Corporation

Air Purifying—Air Cooling—Humidifying—Dehumidifying—Industrial Ventilation—High and Low Temperature Drying—Generator Coolers—Dust Removal—Reclamation.

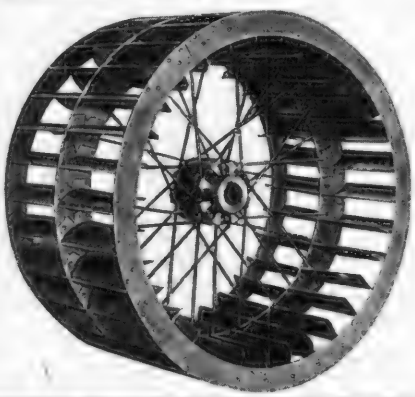
Webster Air Washers

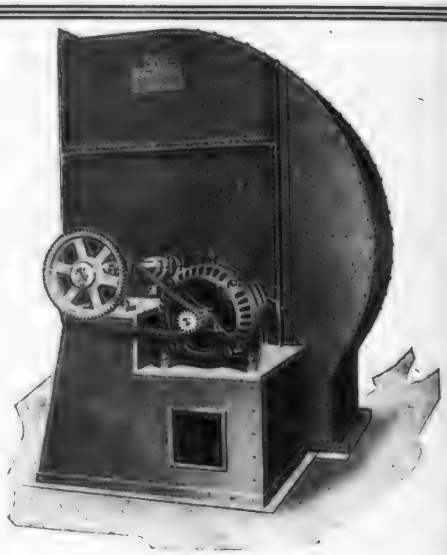
LAFAYETTE BLDG.
PHILADELPHIA

The Fan and the Wheel

PLEXIFORM

Maximum air delivery against low or medium-high resistance from a minimum of housing
Highest obtainable mechanical efficiency
Strength
Lightness
Quietness in operation

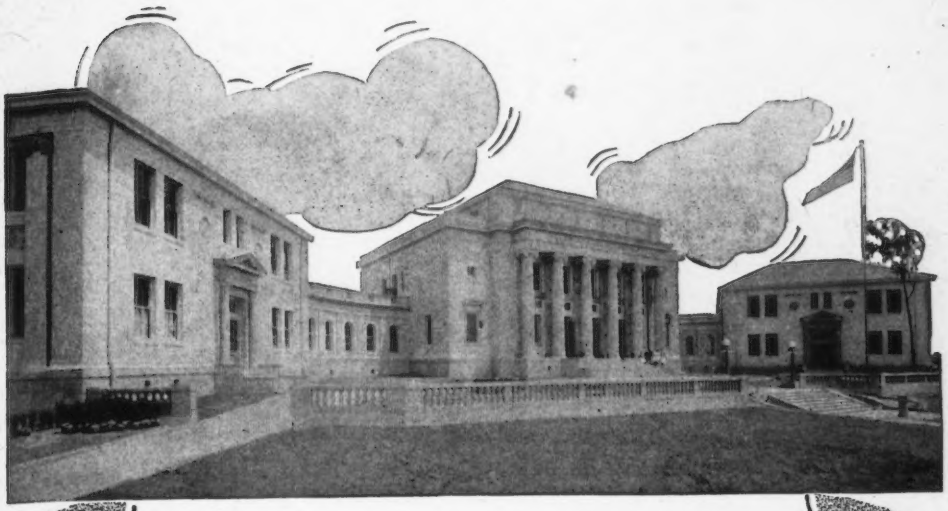




A method of construction equally adaptable to high as to low pressures and as practicable for double-width as for single-width fans.

Our Bulletin 17-V is a handbook on fan design
Sent on request

BAYLEY MFG. CO., Milwaukee, Wis.



Specify Buffalo

One of the important factors of every building about to be constructed is the heating system. Obviously to give the client the most for his money is the first consideration.

It is comparatively simple to install a heating system, but it is another matter to make it always efficient.

Buffalo Fan Systems are no higher in first cost, and their upkeep is offset by the saving in heat; the increase in efficiency of the workers.

Putting heat mechanically just where it is wanted by keeping it in circulation instead of letting it escape thru the ventilation in the roof, is the cheapest and best way.

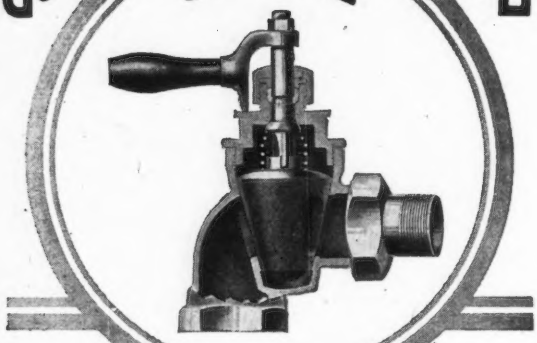
Catalog No. 198 gives valuable engineering data on heating and ventilating problems. Our engineering department is always available for consultation.

Write Dept. No. 36

BUFFALO FORGE CO.

BUFFALO. N. Y.

GORTON QUICK VALVE OPENING



Would you use a door knob that required five or six turns of the wrist to open a door?

Then why use a valve that requires nine or ten turns of the wrist to operate?

A quarter turn of the wrist opens or closes the Gorton Valve.

This makes it easy to operate the valve and radiators will then be shut off when heat is not required, and that means

Saving Coal

It is a valve that is made tight and stays tight.

Write for Catalogue telling how it is done.

See SWEET'S CATALOGUE for Specifications

GORTON & LIDGERWOOD CO.

100 Liberty Street

New York, N. Y.

The building is two stories high and has accommodations for 500 guests. It was built partly on account of the lack of rooming and boarding accommodations within a desirable distance from the plant. The club has its own heating and lighting plant and all of the bedrooms are heated by steam.

American Pressweld Radiator Corporation, Detroit, Mich., announces that Charles S. Hopkins, a well-known heating and ventilating engineer, formerly connected with Bartlett-Hayward Company, of Baltimore; Evans-Almirall Company, of New York, and during recent years manager of the Kansas City branch of Richardson & Boynton Company, of New York and Chicago, has joined the staff of the radiator corporation and will have his headquarters at the corporation's main offices in Detroit. Mr. Hopkins, it is stated, was the originator of the tank-in-basement idea, with mercury seal, for hot-water heating plant, and presented his idea to The American Society of Heating and Ventilating Engineers. A number of concerns have since commercialized the scheme under different names. The corporation states that it is quite probable that it will have some important announcement to make in the near future regarding new types of individual heaters.

Illinois Engineering Co., Chicago, Ill., has made arrangements with the De Ved-Kissick Co., New York, to act as the company's eastern representative, for the sale of Eclipse steam specialties, Illinois vapor and vacuum heating systems in New York state, New Jersey and Connecticut. The vapor and vacuum heating department will be in charge of A. L. Browne, who has had much experience in handling this system.

Carrier Engineering Corporation, New York, published a unique Christmas card

BI-CAL-KY Ventilators

No power bills with this fan. The air that passes over your building furnishes the power to ventilate it.

We Guarantee Results

Write for information

BICALKY FAN CO.
Buffalo, N. Y.

Foch Brought Results

—only after having centered in him

All The Control
All The Responsibility

When the heating engineer controls conditions that would otherwise militate against success,

When the heating engineer is no longer only half but wholly responsible for results,

When he knows the heat he has furnished will stay where it is put,

He may then design with an understanding scientific intelligence covering existing actualities.

He will then and only then be the master of the definite situation which he himself has created.

ANNOUNCEMENT

Proven facts and figures will be presented in subsequent issues of this publication justifying from every engineering standpoint the inclusion of the most efficient weather strip in and as a part of your heating specifications. Our forthcoming data will be worth study if you are interested in convincing justification of your demand to heat, not the great unknown, but a constant controllable by your own writing of specifications.

MONARCH METAL WEATHER STRIP CO.

St. Louis, Missouri

which it distributed during the holiday season, incidentally calling attention to "ye Carrier engineers, who manufacture ye weather to order, ye Xmas cold in July, ye July heat at Xmas, ye Arizona drought in Maine and ye New England fog in Denver."

Foster Engineering Co., Newark, N. J., manufacturer of automatic valve specialties, announces the appointment of Charles R. Emerson as general sales manager for the company, effective January 1. Mr. Emerson was formerly manager of the company's Boston branch. For the past six years he has been manager of the company's Philadelphia office.

New Corporations.

Better Heat Service Corporation, Adams, N. Y., capital $55,000, to manufacture boilers, furnaces and coal-saving devices. Incorporators: C. P. Cronin, E. M. Rieth and W. S. Rice, all of Adams.

Titan Furnace Co., Buffalo, N. Y., capital $100,000 to construct boilers, furnaces, and heating and power plants. Incorporators: M. W. Comstock, 39 Erie St., and G. S. Kent, 85 Winslow Ave., Buffalo; and F. F. Williams, 904 D. S. Morgan Building, Buffalo.

United States Fuel-Saving Equipment Corporation, Charlottesville, Va., capital $250,000, to manufacture stoves, etc. Incorporators: A. D. Dabney and W. A. Gibson.

Fuel Savings Heater Corporation, Syracuse, N. Y., capital $550,000.

Backus Heater & Foundry Co., Boston, Mass., capital $50,000, President, William J. Townsend; treasurer, Walter P. Sprigg, 185 Devonshire St., Boston.

Livingston Radiator Corporation, New York, capital $100,000 to manufacture radiators and heating equipment. Incorporators: A. H. Noble, C. C. Webster and D. H Livingston, 30 Broad St., New York.

FOR SALE.

I have patents and patents applied for on the following: a cast-iron water tube down-draft or direct draft heating boiler; a vacuum or gravity return line steam trap for underground steam mains; a steam supply radiator or coil valve; an insulated radiator jacket, with hand and automatic temperature control. I will sell any or all of the above devices, or arrange to manufacture them on a royalty basis. E. H. Murphy, engineer, 1016 Marquette Building, Chicago, Ill.

PRESSWELD RADIATION

TRADE MARK

Write Dept. "D" for calalog today

THE FACT that *Pressweld Radiation* shows a vast saving in fuel (heating and cooling remarkably fast) —that it can be installed in out-of-the-way places— is much more cleanly and sanitary—yet costs no more than the old style cast iron radiator—is why so many installations are being made. The light weight—the quick handling—the low transportation charges—and many other advantages will interest you. Investigate *Pressweld.* Our catalog has some valuable pointers on modern installation work. Get your copy—*now.*

The AMERICAN PRESSWELD RADIATOR CORPORATION
DETROIT, MICHIGAN

Please mention THE HEATING AND VENTILATING MAGAZINE *when you write.*